

A Guide for the Development of Astrotourism

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A Guide for the Development of Astrotourism

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- Anogeia, Greece (Best Tourism Village)
- Cumeada, Portugal (Best Tourism Village)
- Rupit, Spain (Best Tourism Village)
- San Cosme y Damián, Paraguay (Best Tourism Village)

Foreword

by Ms. Shaikha N. Alnuwais
Secretary-General,
World Tourism Organization (UN Tourism)



The night sky represents one of humanity's most universal and yet increasingly fragile natural assets. As tourism continues to evolve, destinations face the challenge of developing tourism products that integrate culture and nature while remaining compatible with environmental responsibility and territorial balance. In this context, astrotourism is emerging as an area with the potential to support sustainable destination development, foster knowledge exchange and create value rooted in local heritage.

At UN Tourism, we view astrotourism as an example of how thematic areas can contribute to a more diversified, resilient and sustainable tourism sector when approached in a structured and responsible manner. Jointly developed with the Starlight Foundation, an Affiliate Member of UN Tourism, this guide reflects the Organization's commitment to supporting Member States and destinations through practical guidance for the planning, management and promotion of astrotourism. Its purpose is to provide a reference framework that supports informed decision-making and coherent integration of the night sky into tourism strategies.

The preparation of this publication has benefited from the active involvement of UN Tourism Affiliate Members, whose expertise and practical experience have been central to its development. In particular, the destinations of La Palma and Tenerife (Spain) have made a significant contribution, sharing operational experience and insights that demonstrate how long-term legal protection of the night sky, scientific excellence and public-private cooperation can be translated into coherent tourism strategies, offering a valuable point of reference for destinations worldwide.

Additional contributions from Affiliate Members further reflect the diversity of approaches through which astrotourism can be developed. The State Tourism Advisory Council of Yucatán (Mexico) contributes experience rooted in cultural interpretation and archaeoastronomy; the Petra Development and Tourism Region Authority (Jordan) provides perspectives on the relationship between skyscapes and archaeological heritage; and PROMPERÚ (Peru) shares destination level experience in integrating astronomy related activities within broader tourism development frameworks. The publication also draws on insights emerging from rural destinations recognized through the Best Tourism Villages by UN Tourism initiative, illustrating how tourism linked to the night sky can support development in rural areas by creating low impact tourism products that build on local landscapes, cultural heritage and community knowledge, while contributing to economic diversification, skills development and year-round visitation.

Drawing on all these experiences, UN Tourism will continue to rely on the expertise of its Affiliate Members as a source of applied knowledge and practical insight across its thematic work. This collective experience supports the Organization's broader efforts to assist destinations in developing tourism policies and products that are sustainable and responsive to local development priorities.

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Foreword

by Ms. Antonia Varela
Director, Starlight Foundation



This guide is the joint result of UN Tourism and the Starlight Foundation developed within the broader cooperation framework with UN Tourism Affiliate Members. Special recognition is extended to La Palma and Tenerife, as well as to other collaborating entities whose contributions have been instrumental to this publication. Its launch coincides with a growing international interest in tourism experiences linked to dark skies, reflecting a wider commitment to sustainability, environmental awareness and nature-based travel.

For the Starlight Foundation, a non-profit organization created at the initiative of the Institute of Astrophysics of the Canary Islands, it is both an honour and a responsibility to contribute to this publication as the coordinating entity. We would like to express our sincere appreciation to UN Tourism for the trust placed in our experience and our long-standing commitment to the protection of the night sky and the development of astrotourism worldwide.

This guide is grounded in the principles set out in the Declaration of La Palma, adopted in April 2007 with the participation of leading international institutions, including UN Tourism, the International Astronomical Union and UNESCO. The Declaration established a pioneering international framework by recognizing the night sky as a common heritage of humanity and affirming its universal value from scientific, cultural, environmental and social perspectives. It also laid the foundations for considering the sky as a resource for tourism, provided that its use is based on a firm commitment to territorial preservation and responsible environmental management. Additionally, to the values recognized in the Declaration the sky is closely linked to nocturnal biodiversity, landscapes, traditional knowledge, cultural identity and human well-being. Its protection and responsible use contribute to energy efficiency, environmental sustainability and improved quality of life, while reinforcing broader climate and sustainability policies.

In this context, astrotourism has become a genuine opportunity for socioeconomic development, particularly in rural areas and territories with low population density. It supports the diversification of tourism products, the generation of local employment, the strengthening of territorial cohesion and the enhancement of natural and cultural heritage, while fostering public awareness of the importance of preserving the night sky and promoting the implementation of efficient and sustainable lighting systems.

This publication aims to serve as an international reference, providing criteria, tools and good practices to improve understanding of astrotourism and to support its responsible development as a driver of sustainability, innovation and territorial development. From the Starlight Foundation, in close cooperation with UN Tourism, we reaffirm our commitment to a form of tourism that protects, educates and transforms; one that recognizes the sky not only as a legacy to be preserved, but also as a shared opportunity to build a more sustainable future.

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Foreword

by Ms. Dimple Melwani
CEO, Tenerife Tourism Board



Tenerife is widely recognized as a destination of excellence, known for its exceptional climate, rich natural environment, diverse leisure offer, authentic local culture and first-class hotel facilities. In recent years, the island has also made a strong commitment to digitalization and sustainability, embracing not only environmental objectives but also economic and social responsibility.

Beyond these attributes, Tenerife takes great pride in its cultural and heritage values. The island is home to deeply rooted ancestral traditions and vibrant festivities that reflect its unique identity. Its cultural offer is further enriched by renowned institutions such as the Museum of Nature and Archaeology, the TEA (Tenerife Espacio de las Artes) and the iconic Tenerife Auditorium, designed by Santiago Calatrava, which hosts a year-round programme of opera, classical music concerts and theatrical performances.

Complementing this cultural wealth, the island also boasts an outstanding historical heritage. Notable examples include the city of San Cristóbal de La Laguna, a UNESCO world heritage site, as well as the historic centres of La Orotava, Garachico and Icod de los Vinos, among many other heritage-rich locations distributed across the island.

Astrotourism has long been an integral part of Tenerife's identity. Its exceptionally clear skies, which allow the universe to be observed with remarkable clarity, represent one of the island's most distinctive natural assets. This has led to Teide National Park and the Cumbres de Tenerife mountains being awarded with the Starlight certification, recognising them internationally as privileged destinations for stargazing.

This guide, developed by the Starlight Foundation and UN Tourism, constitutes a valuable tool for the creation of tourism products and experiences that connect nature and culture with the sky. Tenerife's support for this publication reflects the island's firm commitment to astrotourism and sustainable development, and its hope that the island's experience may serve as inspiration for other destinations seeking to responsibly harness the potential of the night sky.

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Foreword

by Ms. Raquel Rebollo Morera
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La Palma possesses certain unique environmental features which have earned it the distinction of a UNESCO World Biosphere Reserve. Its exceptional natural values, shaped by volcanic landscapes, native ecosystems and a strong commitment to conservation, position the island as a benchmark for sustainable development and environmental stewardship.

At its highest point, over 2,400 metres above sea level, the Roque de los Muchachos Observatory rises above the so-called *sea of clouds*, benefiting from an exceptionally clear, stable and dry atmosphere influenced by the Atlantic Ocean. These conditions place La Palma among the most privileged locations in the world for astronomical observation and scientific research related to the night sky.

In order to prevent excessive light pollution and preserve this natural asset, the island has been protected by specific legislation, becoming the first Starlight Reserve worldwide and, in 2012, being officially recognized as a Starlight Tourist Destination. The legal and institutional framework reflects La Palma's long-standing commitment to safeguarding the quality of its night skies and integrating astronomy-related activities into its tourism model in a responsible and sustainable manner.

La Palma therefore offers exceptional conditions for experiencing and interpreting the scientific, cultural, natural and landscape values associated with the night sky. The firmament forms an integral part of the island's identity and heritage, providing opportunities for education, scientific dissemination and meaningful engagement with nature.

This commitment was formally expressed on 20 April 2007, when La Palma hosted the signing of the Declaration in Defence of the Night Sky and the Right to Starlight (the La Palma Starlight Declaration). The Declaration affirms that an unpolluted night sky, enabling the enjoyment and contemplation of the firmament, should be considered an inalienable right, equivalent to other sociocultural and environmental rights.

This publication invites travellers with a special appreciation for dark skies to discover La Palma as a destination where nature, culture and science converge under extraordinary night-sky conditions. The island's support for this publication reflects its openness to welcoming visitors who value the preservation of darkness and its commitment to sharing this unique heritage responsibly with the world.

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Executive summary

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Astrotourism is emerging worldwide as destinations recognize the night sky as a valuable natural, cultural and scientific resource. This publication, *A Guide for the Development of Astrotourism*, offers practical guidance to help destinations plan, develop and manage astrotourism in a sustainable and responsible way, reflecting rising interest in nature-based travel, learning experiences and activities connected to astronomy.

The Starlight Foundation defines *astrotourism* as "a tourism activity that involves night and day sky observation, educational outreach, scientific research and astronomy-related leisure". The concept draws on three complementary perspectives: (i) the scientific study of the sky; (ii) the cultural and historical importance of celestial knowledge; and (iii) the appreciation of the night sky as part of natural heritage. Together, these elements demonstrate the potential of astrotourism to strengthen environmental awareness, preserve cultural traditions and support local development. While space-related travel is gaining attention globally, this publication focuses exclusively on terrestrial astrotourism.

High-quality dark skies are the core resource for most astrotourism activities, yet they face growing threats from light pollution and unregulated development. Cultural resources – such as myths, astronomical heritage and archaeological sites – enrich interpretation, while technological tools, from observatories to mobile apps, make astronomy accessible to diverse audiences. Storytelling emerges as a powerful component, enhancing visitor experience and connecting astronomy with local identities.

Infrastructure is essential for safe and enriching experiences, including access to dark-sky areas, safe night-time mobility, observatories, planetariums, viewpoints and appropriate accommodation. Visitor motivations vary from scientific curiosity and discovery to relaxation to spirituality and creative pursuits, highlighting the need for diverse, inclusive and well-designed experiences.

Effective communication is key to showcasing the night skies of a destination. Strong narratives, night-sky photography, digital outreach and coordinated partnerships help raise visibility, while clear objectives and indicators support long-term planning.

The guide also presents global examples of astronomical heritage, combined tourism products, accessibility considerations, sustainability principles and practical case studies. It concludes with recommendations for member states and destinations on strengthening governance, protecting dark skies and creating high-quality, inclusive and environmentally responsible astrotourism experiences.

Introduction

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Interest in the night sky is rising globally as more travellers seek experiences that reconnect them with nature, offer moments of reflection and allow exploration of destinations from a different perspective. Clear, unpolluted skies are increasingly valued as an element of the visitor experience – especially in rural and remote areas where darkness and silence remain part of the landscape. These environments support a range of low-impact activities combining observation, learning and appreciation of nature, and offer communities a chance to diversify their tourism offerings in a way that reflects local identity and heritage.

Recent data from major global travel platforms illustrate this shift in motivation. The *Trendcast 2025* from Tripadvisor (based on millions of reviews, bookings and user-generated data) identifies a growing interest in outdoor and nature-based experiences, with darker sky destinations among the emerging categories.[1] Meanwhile, the Booking.com *Travel Predictions 2025*, compiled from a global survey of more than 27,000 travellers across 33 countries, signals a broader re-evaluation of travel norms – with many travellers expressing interest in nocturnal activities, dark-sky destinations and *starbathing* as part of more meaningful holiday experiences.[2]

Across multiple regions, travellers are responding to changing climate patterns, overcrowding and a desire for slower rhythms, by planning trips around cooler evenings, quiet nights and experiences that reconnect them to natural cycles. At the same time, communities – especially in rural and remote areas – are exploring how to integrate the night sky into their tourism offer, combining astronomy, nature, cultural heritage and local identity. In many places, the preservation of dark skies is seen not only as an environmental concern but as a potential asset for sustainable tourism, cultural heritage and community development.

Within this dynamic context, astrotourism has gained prominence. What once was a niche set of astronomy-related activities has expanded into a broader field that fuses scientific interest, cultural meaning and nature-based tourism. This publication examines that evolution and provides key definitions and concepts, as well as it explores the conditions that shape the quality of the night sky as a tourism resource. It offers a foundation to understand the growing role of astrotourism within sustainable, community-based and heritage-oriented tourism development.

1 Tripadvisor (2025), '2025 Travel Trends from Tripadvisor: Trendcast 2025', Tripadvisor, Needham, available at: https://www.trendcast.tripadvisor.com/ [28-11-2025].

2 Booking.com (2024), 'Travel Reinvented: Booking.com's 2025 Travel Predictions', Booking.com, Amsterdam, available at: https://www.booking.com/articles/travelpredictions2025.en-gb.html [28-11-2025].

Astrotourism: a broad concept

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Based on the definition by the Starlight Foundation, for the purpose of this report, astrotourism is defined as:

"[...] a type of tourism activity that involves night and day sky observation, educational outreach, scientific research and leisure activities related to astronomy."[3]

Most definitions, including that of the Starlight Foundation, recognize astrotourism as an activity that benefits the environment and empowers local communities. It serves as a valuable tool for promoting less visited regions, offering them an opportunity to attract more visitors.

Some experts nowadays consider a broader concept of astrotourism to integrate space tourism and terrestrial astrotourism.[4] *Terrestrial astrotourism* – the focus of this publication – corresponds to the aforementioned definition, whereas *space tourism* would refer to stratospheric flights, suborbital flights, low Earth orbit (LEO) flights and observing spacecraft launches on spaceports, such as Cape Canaveral, United States of America.

The concept of *terrestrial astrotourism* today, hereafter *astrotourism*, is the result of three complementary perspectives: the first one, based on a scientific interest for astronomy; the second, on the cultural value of the night sky for civilizations throughout human history; and the third, related to ecotourism and the night sky as part of our natural heritage.[5]

The diversity of activities that fall into the category of astrotourism is remarkable: from travelling to stargaze and experience astronomical phenomena such as solar eclipses or auroras, to chasing the best night skies for astrophotography, through experiences as varied as visiting scientific observatories, urban planetariums or ancient astronomical sacred sites, among others. This intrinsically diverse nature leads experts to characterize astrotourism as attracting both niche audiences and larger ones. Traditionally, astrotourism has been viewed as a niche tourism product, appealing to specialized audiences interested in astronomy-related activities such as dark sky observation and astrophotography. At the same time, it also draws larger audiences through organized events, public observatories and dark-sky reserves, making it accessible to a broader range of travellers.[6] Some experts argue, therefore, that certain astrotourism activities can attract large numbers of travellers, such as eclipse events.[7]

To aid understanding this publication, a glossary with specialized terms related to astronomy and astrotourism is included at the end of the publication, as well as a list of key concepts on dark skies and the factors influencing the quality of night skies for astronomical observation.

3 Starlight Foundation (2021), 'The Astrotourism by the Starlight Foundation', Starlight Foundation, San Cristóbal de la Laguna, available at: https://en.fundacionstarlight.org/ [08-12-2025].

4 Pásková, M.; Budinská, N. and Zelenka, J. (2021), 'Astrotourism – Exceeding Limits of the Earth and Tourism Definitions?', *Sustainability,* volume 13(1), 373, DOI: https://doi.org/10.3390/su13010373.

5 Fernández Hernández, C.; Araña Padilla, J. and León González, C.J. (2017), *Estudio del producto de Astroturismo en la isla de La Palma,* ECOINTUR, Tenerife, p. 31.

6 Soleimani, S. et al. (2019), 'Astro-tourism conceptualization as special-interest tourism (SIT) field: a phenomenological approach', *Current Issues in Tourism,* volume 22 (18), pp. 2299–2314, DOI: https://doi.org/10.1080/13683500.2018.1444021.

7 Pásková, M.; Budinská, N. and Zelenka, J. (2021), 'Astrotourism – Exceeding Limits of the Earth and Tourism Definitions?', *Sustainability,* volume 13(1), 373, DOI: https://doi.org/10.3390/su13010373.

Artuner Özder, C. G. (2024), *Astro-tourism: a growing niche of sustainable tourism,* Detay Yayincilik, Ankara, p. 74.



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01
Using astro-resources for tourism

Abstract:
This chapter explores how natural, cultural and technological resources shape astrotourism and create engaging visitor experiences. Pristine dark skies are the core natural asset, offering ideal conditions for observation. Cultural elements – myths, legends and historical sky knowledge – add meaning, strengthen place identity and support community involvement. Technology, from telescopes to augmented reality, enriches interpretation. Special event programming, such as meteor showers or eclipses, draws diverse audiences, while combining stargazing with outdoor activities or gastronomy broadens appeal. The chapter underscores the power of narratives and storytelling to transform simple observation into an immersive experience that connects visitors with scientific discovery and cultural heritage.

Key words: quality dark skies | natural resources | cultural resources | technological resources | narratives | storytelling | combined integrated experiences

Key message:
Astrotourism is an activity that combines sky observation with cultural and natural resources. While a quality night sky is its primary natural resource, destinations must also draw on their unique natural and cultural assets to diversify their offerings. Developing engaging narratives helps create unique experiences that strengthen their identity and enhance their appeal. Astrotourism has become a growing tourism product, offering unique experiences focussed on observing the night sky and celestial phenomena. This type of tourism leverages natural, cultural and technological resources to create educational and recreational experiences that attract a wide range of visitors.

Waiting for nightfall from the Llanos de Los Jables, El Paso, La Palma, Spain. © González, A.

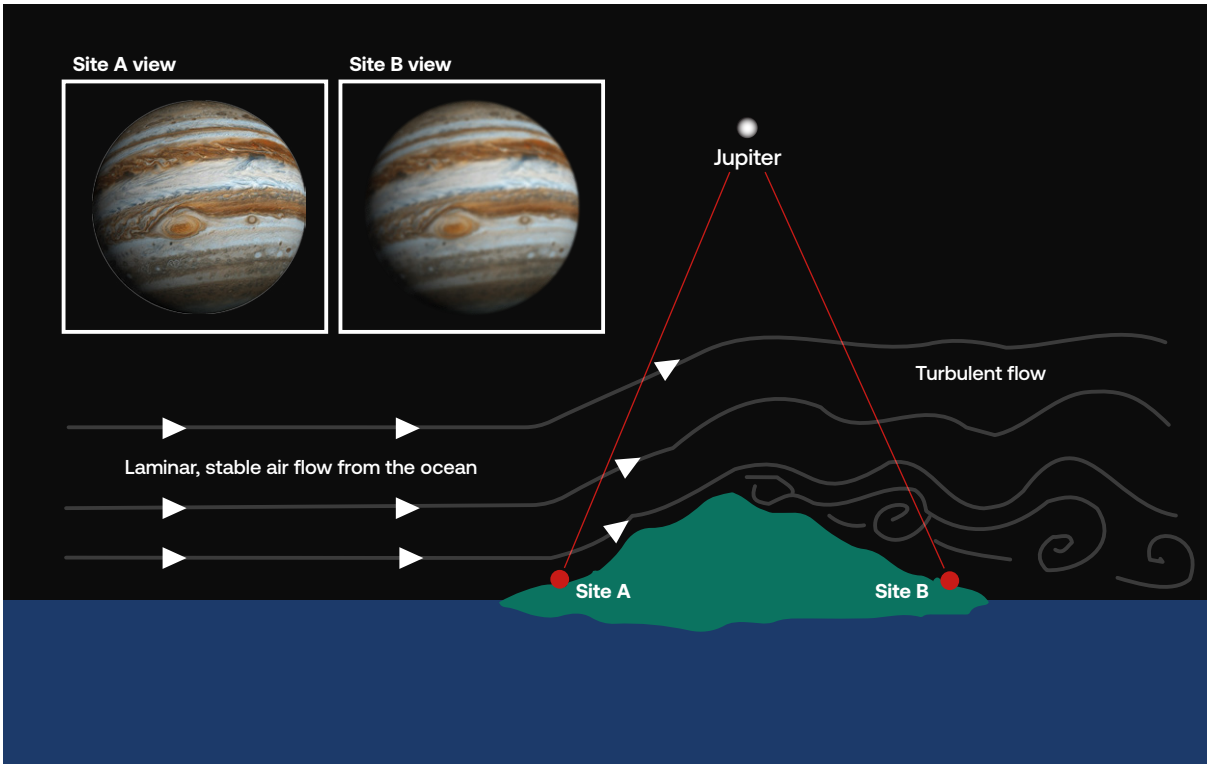
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1.1 Natural and cultural resources

The most important natural resource for astrotourism are quality dark skies: most astrotourism activities rely on pristine night skies, free from light pollution. The rapid growth of light pollution, estimated to increase by 6% annually, has significantly diminished this resource, threatening both its aesthetic and scientific value, which is why dark sky preservation and public sensitization on this problem is a cornerstone for astrotourism.[8]

Quality skies for astrotourism not only require minimal light pollution but also appropriate weather (with low cloud coverage) and atmospheric conditions, that in turn determine the astronomical seeing, i.e., the clarity and stability of astronomical observations: good seeing conditions mean objects appear sharp and steady, while poor seeing conditions cause stars to twinkle and objects to blur.

Figure 1.1 **Effect of atmospheric stability on astronomical seeing of celestial objects**



Note: A stable atmosphere allows to see celestial objects such as Jupiter clearly from site A, whereas in site B an unstable atmosphere causes the image of that same object to blur.

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8 Tapada, A.; Marques, C.S.; Peixeira Marques, C. and Costa, C. (2021), 'Astrotourism: a literature review and framework for future research', *Enlightening Tourism. A Pathmaking Journal*, volume 11(2), pp. 291–331, DOI: https://doi.org/10.33776/et.v11i2.5189.

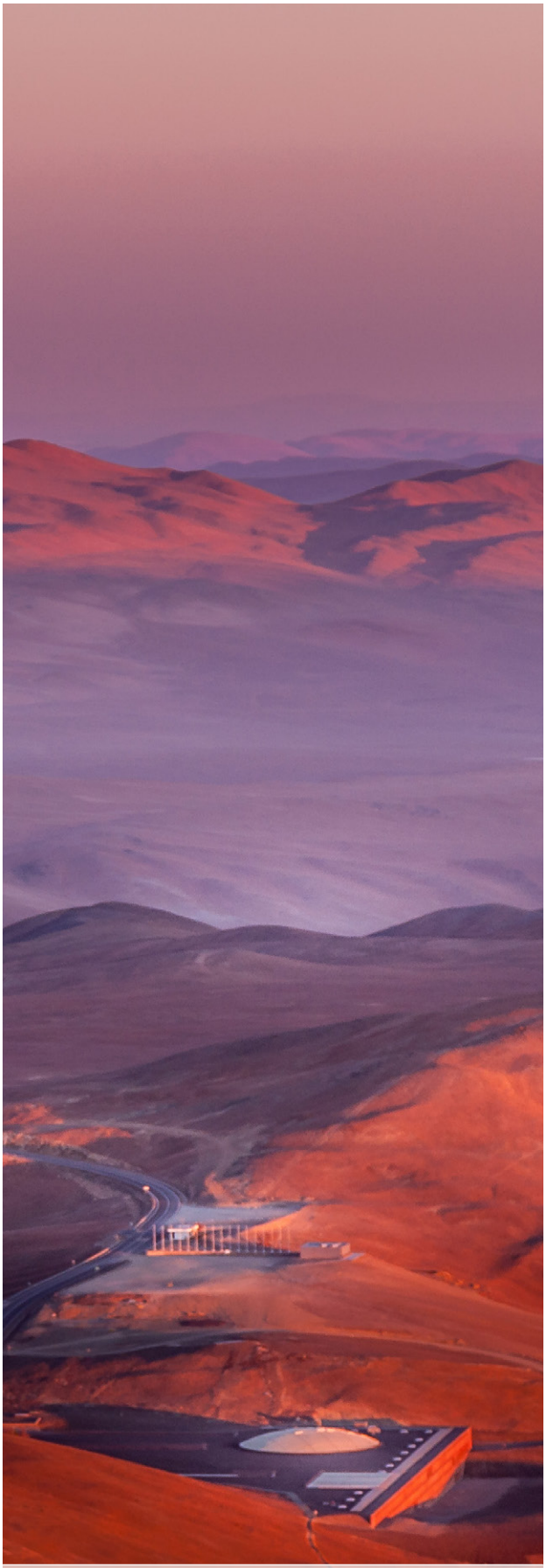
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Furthermore, natural and cultural resources play a fundamental role in shaping tourism experiences and offerings. Natural resources encompass geomorphological and biophysical elements or a combination of both, whose unique characteristics make them attractive to tourists. These resources are defined by their physical abundance and distribution, which depend on natural conditions rather than human creation. However, while they cannot be produced by humans, they may be modified or enhanced to facilitate visitor access and sustainability for tourism.

Cultural resources include human-made elements that appeal to visitors through their historical or contemporary significance. Historical cultural resources are manifestations of past cultures, such as ancient architecture, traditions or artifacts, while contemporary cultural resources reflect current human creativity and innovation.[9]

1.2 Technological resources

Technological infrastructure also plays a crucial role. This includes telescopes of high quality or on amateur level available to visitors, both in public observatories and private facilities. Moreover, modern technology such as mobile apps and augmented and virtual reality devices can enhance the user experience, allowing them to identify constellations and planets, and receive real-time information on astronomical events.



Base of Paranal Observatory, Chile.
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9 García Silberman, A. (1970), 'Clasificación de los recursos turísticos', *Boletín del Instituto de Geografía*, México, vol. III, pp. 61–65.

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1.3 Taking advantage of astrotourism resources

Special event programming is an effective way to make use of astrotourism resources, attracting visitors to unique celestial experiences. Events such as meteor showers, solar and lunar eclipses, auroras and planetary oppositions draw large audiences eager to witness these phenomena. Some celestial events, like total solar eclipses or rare planetary alignments, occur only a few times in a lifetime or even across centuries, making them particularly significant attractions.

Organizing observation events with expert guides, educational talks and interactive activities – such as night photography workshops and telescope viewings – enhances visitor engagement and deepens public understanding of astronomy. These events appeal not only to local enthusiasts but also to national and international travellers looking for immersive astrotourism experiences. Promoting them through tourism boards, digital marketing and collaborations with scientific institutions helps expand their reach. Combining these events with other activities, such as cultural programmes, guided stargazing excursions or local gastronomy, further enriches the experience and strengthens the appeal of destinations.[10]

Additionally, astrotourism can be integrated with other types of tourism, creating combined experiences. For example, activities such as night hiking, camping under the stars, or astronomical observation cruises can complement sky-watching, offering a more holistic experience. Including cultural and historical elements, such as local cuisine, or the interpretation of myths and legends related to constellations and the astronomical histories of local cultures, can also enrich the tourism offering. More on these combined integrated astrotourism experiences can be found in chapters 5 and 6.

Table 1.1 **Tourism impact of certain recent astronomical events**

Astronomical event	Tourism impact
Total solar eclipse	On 18 April 2024, in New York State, nearly 1 million visitors flocked to state parks to witness the eclipse.[a]
Northern lights (aurora borealis)	A 2024 Expedia survey reported a dramatic increase in searches for northern lights, with destinations such as Lapland in Finland soaring by 370%.[b]
Perseid meteor shower	In 2024, the Perseid meteor shower attracted a crowd of around 20,000 people to the Karacabey coast, Turkey.[c]
Guided stargazing activities	The Colorado Plateau, United States of America, alone expects astrotourists to spend USD 5.8 billion between 2020 and 2030.[d]

Sources:
a) Roberts, D. (2024), 'It was a year that lit up the skies and shook the earth', published on 29 December 2024, *Times Union*, available at: https://www.timesunion.com [30-03-2025].
b) Grand View Research (2024), *Northern Lights Tourism Market (2025–2030)*, GVR, San Francisco, available at: https://www.grandviewresearch.com [08-12-2025].
c) Hürriyet Daily News (2024), 'Thousands gather in Bursa to watch Perseid meteor shower', published on 5 August 2024, Hürriyet Daily News, available at: https://www.hurriyetdailynews.com [12-08-2025].
d) Mitchell, D.M. and Gallaway, T. (2019), 'Dark sky tourism: Economic impacts on the Colorado Plateau economy, USA', *Tourism Review*, volume 74 (4), pp. 930–942, DOI: https://doi.org/10.1108/TR-10-2018-0146.

10 Starlight Foundation (2021), 'The Astrotourism by the Starlight Foundation', Starlight Foundation, San Cristóbal de la Laguna, available at: https://en.fundacionstarlight.org/ [08-12-2025].

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1.4 The role of narratives and stories in astrotourism

Narratives and stories play a pivotal role in shaping astrotourism experiences. By weaving tales that connect the historical and cultural uses of the night sky with contemporary stargazing practices, tourism operators can create richer and more immersive experiences that go beyond mere observation. These narratives engage tourists and contribute significantly to the identity and sustainability of the destination.

One of the most powerful aspects of storytelling in astrotourism is its capacity for *place creation* and fostering place identity: By sharing local myths, legends and historical accounts related to celestial navigation, agricultural cycles or spiritual beliefs, destinations transform into living spaces imbued with cultural meaning. These narratives help root the astrotourism experience in the local context, creating a sense of connection for tourists and strengthening community identity. Narratives, especially those involving myths and elements of fantasy, shape the social construction of tourism destinations. They help define what tourists expect and how they engage with the location, turning each visit into a journey that blends imagination, history and scientific discovery.[11] At the same time, storytelling and narratives act as valuable tools for safeguarding traditions and cultural heritage. In many rural or remote destinations, stories risk disappearing across generations, particularly as younger populations migrate to urban centres for economic reasons. By embedding these narratives into astrotourism experiences, communities can preserve intangible cultural heritage while sharing it with visitors.

This process of place creation is closely tied to the concept of the *experiencescape*,[12] which highlights the interplay of physical and social elements in shaping tourist experiences. In the context of astrotourism, the physical elements include the observable night sky, telescopes and the natural environment, while the social elements consist of the narratives, the storytelling skills of guides and the cultural richness shared during the experience. Together, these elements create a holistic environment that affects how tourists perceive and interact with the site. Narratives act as bridges, turning the scientific observations of the stars into meaningful cultural and personal stories, thus shaping the gaze of tourists – the way they view, interpret and emotionally connect with the experience.

Stories about the night sky are particularly effective because they resonate on multiple levels. They appeal to curiosity, foster emotional connections and inspire a sense of wonder. For example, a story about how ancient civilizations used the stars to guide their journeys or mark time can give visitors a new appreciation for the ingenuity of those cultures. Similarly, local myths about constellations or celestial events can create a deeper emotional engagement, transforming the night sky from a distant, abstract concept into a tangible and meaningful part of the identity of the destination.

11 Amoamo, M. (2013), '(de)constructing Place-Myth: Pitcairn Island and the "Bounty" Story', *Tourism Geographies*, volume 15 (1), 107–124, DOI: https://doi.org/10.1080/14616688.2012.699093.

12 Baker, M.A. and Kim, K. (2020), 'The service experiencescape', in: Dixit, S. (ed.), *The Routledge Handbook of Tourism Experience Management and Marketing*, Routledge, London, pp. 150–158, DOI: https://doi.org/10.4324/9780429203916.

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Stars reflected in the salt flats of Fuencaliente, La Palma, Spain. © González, A.

Another dimension worth considering is the sensory aspect of the night environment. Darkness naturally reduces external stimuli and distractions, creating conditions in which visitors become more introspective and more receptive to subtle perceptions. The combination of low-light surroundings, quietness and open skies enhances the emotional and cognitive impact of narratives. As a result, storytelling under the night sky can become even more powerful, fostering deeper immersion and personal reflection.

From a practical standpoint, incorporating culturally rich stories into astrotourism programmes offers several benefits: It differentiates the destination by providing unique, authentic experiences, it strengthens connections between visitors and the local culture, and promotes sustainable tourism by emphasizing the value of preserving both cultural heritage and natural environments. Moreover, storytelling is a readily available means of communication, making it an inclusive tool to engage diverse audiences, from astronomy enthusiasts to casual stargazers.[13]

The effective use of astrotourism resources involves a combination of preserving the natural environment, providing adequate technological infrastructure, programming special events, integrating with other forms of tourism and educational efforts. These elements enrich the visitor experience and promote sustainability and the conservation of our dark skies.

13 Gerasimova, D. (2021), 'Astro Tourism – A Possible Path to Sustainable Development through Narratives and Stories', BSc. Thesis, Uppsala Universitet, Uppsala.



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02
Infrastructure for developing astrotourism

Abstract:
Astrotourism may be as simple as travelling to a dark location with a telescope, but developing it as a professional tourism product requires supportive infrastructure. Key elements include observation facilities: professional observatories with advanced telescopes, commercial observatories for enthusiasts, planetariums with sky simulations and astronomy museums or visitor centres. Designated stargazing sites with minimal light pollution and accessible viewpoints are essential. Safe access is crucial, e.g., good roads, transport options, signage and clear night paths. A range of accommodations, from hotels to campsites, should offer services and amenities tailored to astro-tourists to create a comfortable, immersive experience.

Key words: astrotourism infrastructure | observatory | planetarium | astronomical viewpoint | stargazing sites

Key message:
Astrotourism development can be boosted by providing quality observation facilities, strategic locations with minimal light pollution, accessible infrastructure and diverse accommodations. Important elements include observatories, planetariums and astronomical viewpoints, along with proper signage and maintenance of roads and specialized lodging options.

Starry night sky by a lake in the beautiful nature, Estonia. © Dmitri Toms | Dreamstime.com

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Tourism infrastructure comprises the facilities and resources essential for meeting the needs of tourists and ensuring a comfortable stay at a destination. The competitiveness of a destination therefore heavily relies on the availability and quality of these infrastructure elements and related services.

The main components of tourism infrastructure comprise:[14]

- **Basic infrastructure** includes all amenities and facilities necessary for the overall functioning of tourism, regardless the tourism type, i.e., communication and transportation (airports, railway stations and bus services, as well as road networks and signage), accommodation (hotels and other lodging options) and catering (food and beverage), as well as social infrastructure (e.g., water supply, sanitation, sewage treatment, waste management). Internet coverage is also considered a key element of tourism infrastructure: robust Internet connectivity enhances the tourist experience, given the growing reliance on digital tools for trip planning, booking, navigation and enjoyment.

- **Additional infrastructure** encompasses entertainment and recreational facilities, services and themed attractions that enhance the tourism experience.

For astrotourism to develop effectively and for places to establish themselves as astrotourism destinations, it would be essential not only to have clear night skies but also to strategically implement land-based assets and tourism infrastructure. This could enhance celestial observation while facilitating access and accommodation for astrotourists.

The development of an astrotourism destination requires well-designed infrastructure and specialized facilities that attract visitors and meet their expectations. For a seamless experience planning must anticipate demand and ensure an alignment with both the characteristics of the destination and the tourists' needs.[15]

Leading astrotourism hubs around the globe, such as Spain, Chile or the United States of America, offer a good example of the diversity of astronomical infrastructure that provide competitive complementary activities.

14 Slashchuk, A. and Bernadska, H. (2019), 'Scientific approaches to conceptualization and classification of tourist infrastructure', *Ekonomichna ta Sotsialna Geografiya*, volume 81, p. 12, DOI: https://doi.org/10.17721/2413-7154/2019.81.12-17.

15 Fernández Hernández, C.; Araña, J.E.; de León, J. and León, C.J. (2022), 'Tourists' Preferences for Stargazing Land Resources', *Land*, volume 11 (2), p. 198, DOI: https://doi.org/10.3390/land11020198.

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2.1
Modern astronomical observatories

Astronomical observatories are purpose-built buildings equipped with high-powered telescopes, designed for observing celestial objects and phenomena, for both research and educational purposes. Observatories are typically situated at high altitudes, in areas with minimal light pollution and appropriate atmospheric conditions.

Some observatories, such as the Roque de los Muchachos Observatory on the Island of La Palma in Spain or the Silla Observatory in Chile, are devoted primarily to astrophysical international research though they also carry out outreach activities for the general public, including lectures, tours and exhibitions on their professional telescopes and projects. Interestingly, studies have observed that, in La Palma, one of the world's leading astrotourism hubs, visiting professional astronomical observatories is at the top of the preferred astrotourism attractions by astrotourists, regardless of their motivation and previous astronomical knowledge.[16]



El Roque de los Muchachos Astrophysical Observatory on La Palma island, Spain. © Jiménez, Jose

16 Fernández Hernández, C.; Araña Padilla, J. and León González, C.J. (2017), *Estudio del producto de Astroturismo en la isla de La Palma,* ECOINTUR, Tenerife, p. 31.

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2.2 Commercial observatories

Conversely, commercial observatories are astrotourism attractions devoted not to research, but to popularizing astronomy and space exploration amongst the general public and educational groups. Among these, some have a long history of astronomical research, but have ceased their astronomical observations due to light and air pollution nowadays, as it is the case of the Royal Observatory in Greenwich, United Kingdom, whereas others have been built as private tourism observatories that allow astronomy enthusiasts to use their premises to install and make use of their own equipment. These observatories are ideally built with enclosed domes or open-air platforms, choosing designs that minimize vibrations and protect against weather elements.

Planetariums

Planetariums are infrastructures that utilize light projections on a hemispherical dome to illustrate the stars, movements of celestial objects, the appearance of the sky at different seasons, as well as particular astronomical phenomena. Planetariums offer a venue to study the universe and stargaze while being in an immersive, dark, safe, climate-controlled and comfortable environment. Unlike scientific observatories, planetariums are indoor spaces and can occur in suburban and urban areas, since they do not imply the actual observation of the sky through a telescope and therefore do not rely on quality dark skies. Planetariums are especially popular for school children and families.[17]



A view from inside the planetarium at the European Southern Observatory (ESO) Supernova Planetarium and Visitor Center.
© ESO/Hóralek, Petr

17 Artuner Özder, C. G. (2024), *Astro-tourism: a growing niche of sustainable tourism*, Detay Yayincilik, Ankara, p. 74.

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Nowadays there are over 4,000 planetariums in the world, on all continents. Proof of this popularity is the case of the Brno Observatory and Planetarium in the Czech Republic, operational since 1954. It is recognized for its advanced technology and programmes led by prominent scientists. It focusses on astronomy, astrophysics, astrobiology and space science, offering lectures and presentations in various disciplines. Equipped with stereoscopic projection technology that delivers up to 25 million pixels, it ranks among the top three planetariums in Europe for resolution. The facility hosts around 2,000 events annually, including space flight simulations, science fiction experiences and discussions on cosmic mysteries and the future of the solar system.[18]

Astronomy museums and visitor centers

Similar to planetariums, these astronomy-oriented infrastructures are devoted exclusively to education and outreach purposes and are indoor spaces that can be located in all types of environments.

Oftentimes these museums are linked to other infrastructures, like the Royal Observatory of Greenwich (which also includes a planetarium), or the Roque de los Muchachos Visitor Center in La Palma, located right next to the homonymous Astrophysical Observatory, which received over 31,000 visitors during its first year of operation in 2022.[19]

Certified night skies and dark sites

Many parks, reserves and other natural sites across the globe offer near-perfect conditions for observing the stars. Identifying these sites for astrotourism projects is key for destinations to protect their primary resource and inform astrotourists on the best stargazing areas.

For this purpose, oftentimes these destinations seek to certify their night skies. While counting on a certified site is not an essential requirement for astrotourism destinations, certifications can drive greater differentiation and visibility for the destination, as well as inspire confidence in visitors. Two prominent non-profit organizations worldwide that provide certification on quality dark skies are the Starlight Foundation and DarkSky International.

18 Pásková, M.; Budinská, N. and Zelenka, J. (2021), 'Astrotourism – Exceeding Limits of the Earth and Tourism Definitions?', *Sustainability,* volume 13(1), 373, DOI: https://doi.org/10.3390/su13010373.

19 Cabildo de La Palma (2022), *El Centro de Visitantes del Roque de los Muchachos cumple un año desde su apertura con más de 30 000 visitas,* Cabildo de La Palma, available at: https://www.cabildodelapalma.es [18-12-2025].

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Astronomical viewpoints

Astronomical viewpoints are outdoor infrastructures placed in natural locations with the best dark skies to facilitate stargazing. They imply a paved ground to allow for the installation of telescopes and access of vehicles to ease the loading and unloading of heavy optical equipment, as well as informative elements to orientate the visitor's stargazing experience and some public furnishing.

Astrotourism destinations often establish a network of astronomical viewpoints at optimal observation sites, enhancing the gazing experience, fostering familiarity with the destination and promoting access to less-travelled areas.

A study on the preferences of astrotourists on alternative stargazing infrastructures in La Palma, Spain, found out that astronomical viewpoints are preferred by astronomy enthusiasts who can make use of those sites autonomously and with their own observation equipment.[20] Astronomical viewpoints also provide an adequate space for astrotourism companies to carry out their guided experiences, supporting astrotourism entrepreneurship.



Guided stargazing experience at a rural guesthouse in La Palma, Spain. © González, Antonio

20 Fernández Hernández, C.; Araña Padilla, J. and León González, C.J. (2017), *Estudio del producto de Astroturismo en la isla de La Palma*, ECOINTUR, Tenerife, p. 116.

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2.3 Access to quality dark skies

Transportation infrastructure is vital for successful astrotourism, as it determines optimal access to stargazing sites. Since usually the best quality, darkest skies are located in remote and isolated areas, most astrotourism strategies devote efforts to develop, maintain and upgrade the road network and road directional signage, as well as maintaining roads.[21] Efficient transportation options, including public transportation systems, are also important to attract visitors and enhance their experience.

2.4 Accommodation

As with any other tourism products, astrotourism requires sufficient and varied accommodation options to effectively welcome visitors. However, rather than simply increasing accommodation supply, it is essential to consider the carrying capacity of each site. Many astrotourism destinations boast exceptional night skies but are located in remote natural areas with inherent limitations. Therefore, the focus should be on identifying the most suitable types of accommodation that align with the specific needs of this product, while respecting the environmental and logistical constraints of these locations.

Beyond the availability of accommodation, there are certain adaptations that accommodations can undergo to attain greater differentiation and cater to the needs of astrotourists, such as:

- Amenities: Facilities may include the availability of specialized equipment, such as binoculars, telescopes and star charts, as well as blankets or hot beverages to enhance tourists' comfort while stargazing in colder nights.

- Services: As astronomical observation often has astrotourists up until late hours, guests appreciate late breakfast and late check-out policies. Other recommended services include guided night tours and the option to host themed events and workshops in their premises.

21 National Department of Tourism, South Africa (2023), *National Astro-Tourism Strategy & Implementation Plan 2023–2033*, available at: https://www.tourism.gov.za/CurrentProjects/Pages/default.aspx [08-12-2025].

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- Design: Adapting outdoor lighting to minimize light pollution is a first step. Many lodges and hotels incorporate outdoor spaces with unobstructed views of the night sky or even observatories, allowing guests to engage in stargazing right from their accommodations.

Bubble hotels are a highly differentiated option for astrotourism. These offer unbeatable stargazing conditions, provide an immersive experience in any natural environment – be it atop a mountain, in the desert, by the sea or within the forest – and offer the amenities and services of luxurious hotels.[22]

Some accommodations cater specifically to astrotourism, offering ideal conditions for stargazing and promoting awareness of dark sky conservation. These places often provide guests with observation equipment and organize activities such as guided stargazing sessions and astronomy-themed events. Many also align with the principles of the Declaration of La Palma,[23] advocating for the protection of the night sky. To further support these efforts, some choose to obtain certifications like Starlight Rural Hotels and House or Starlight Camps, which recognize their commitment to astrotourism and public engagement with astronomical culture.



Astronomical bubbles at certified Albarari Stella Polaris Starlight Camp, in Sanxenxo, Spain. © Albarari Glamping Burbujas

22 Jain, R. (2024), '10 Bubble Hotels Where You Can Sleep Under the Stars', published on 19 January 2024, *The Travel,* available at: www.thetravel.com [08-12-2025].

23 Starlight Initiative; La Palma Biosphere Reserve; Instituto de Astrofísica de Canarias; Government of the Canary Islands; Spanish Ministry of the Environment; UNESCO MaB (2007), *Declaration in Defence of the Night Sky and the Right to Starlight (La Palma Declaration),* International Conference on the Quality of the Night Sky and the Right to Observe the Stars, La Palma, Canary Islands, Spain, 19–20 April 2007, Starlight Foundation, San Cristóbal de la Laguna, available at: https://en.fundacionstarlight.org [26-11-2025].



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03
Travel motivations and astrotourist profiles

Abstract:
This chapter examines the varied motivations that drive astrotourism and the main visitor profiles. Travellers may seek scientific learning, tranquillity, spiritual fulfilment, novelty, cultural insights into ancient cosmologies, or opportunities for astrophotography. These motivations position astrotourism as both a niche and potentially large-scale segment. Two primary profiles emerge: (i) dedicated astronomy enthusiasts who travel specifically to observe dark skies and celestial events, and (ii) casual astrotourists who include stargazing as one activity within a broader trip. Understanding these groups helps design and communicate tourism experiences that better meet their expectations.

Key words: travel motivations | relaxation | spirituality | astrophotography | stargazing | avid astrotourists | casual astrotourists

Key message:
Although the range of consumer motivations behind astrotourism can be very broad, it boils down to two main astrotourist profiles – astronomy enthusiasts and casual astro tourists – that should be well understood in order to tailor the offer and the communication to meet their needs and expectations.

Ischigualasto Provincial Park, where desert and volcanic landscapes resemble another planet, San Juan, Argentina. © Secretaría de Turismo, Ambiente y Deportes de la República Argentina

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The phenomena of the firmament have attracted people's attention since time immemorial, as evidenced by cave paintings, statues, myths and related narrative arts as well as ancient calendars and sacred sites. Tourism motivated by cosmic phenomena can be perceived as a reflection of how significantly human knowledge, agriculture, medicine, architecture, arts, psychology as well as the emotional and spiritual world have been linked to the perception and cognition of the universe since the times of ancient civilizations.[24]

However, there is still lack of consensus as to where astrotourism lies in when compared to other types of tourism, with some experts stating astrotourism is a form of special interest, niche tourism, and others arguing it also attracts large-scale tourism.[25]

This dual positioning of astrotourism can be explained by the diverse motivations of astrotourists, which in turn define the typologies of astrotourists. Studies coincide that the key travel motivations for astrotourists can be grouped as follows:[26]

- **Educational and scientific interest:** A significant number of astrotourists are driven by a desire to learn more about astronomy and space science.

- **Escape and relaxation:** For some, astrotourism offers a form of escape from the hustle and bustle of daily life. The serene and often remote locations associated with stargazing provide a tranquil environment for relaxation, contemplation and connection with nature. This in turn is closely linked to wellness and health: this is why spas and hot springs under the starry sky are also very interesting attractions for astrotourism.

- **Spiritual fulfillment:** For some individuals, stargazing and contemplating the universe is a deeply spiritual or philosophical activity, as the vastness and beauty of the night sky can inspire feelings of connectedness, introspection and even transcendence, fulfilling deeper emotional and psychological needs. Remote locations allow for a feeling of solitude and a deeper connection with the universe, often intertwined with a broader interest in nature and environmental conservation, as many astrotourism sites are located in pristine natural settings.

- **Awe and discovery:** Observing celestial phenomena provides a sense of awe and wonder, often leading to a meaningful experience of deeper appreciation of the universe and one's place within it. The combination of novelty and meaningfulness can significantly enhance the enjoyable and memorable aspects of the experience.

- **Cultural and historical interest:** The motivation to engage in astrotourism experiences is driven by the desire to understand the link between astronomy and different civilizations, their history and mythology.

- **Astrophotography:** This is a creative motivation for those seeking out pristine skies to capture stunning images of stars, planets and other celestial phenomena. This hobby not only satisfies a creative urge but also provides a tangible record of their experiences.

- **Social and community aspects:** Astrotourism events and activities often bring together like-minded individuals who share a passion for astronomy. This creates opportunities for social interaction, learning from peers, and participating in a community of enthusiasts. Group events such as star parties and observatory tours are popular among these tourists.

24 Artuner Özder, C. G. (2024), *Astro-tourism: a growing niche of sustainable tourism,* Detay Yayincilik, Ankara, p. 74.

25 Pásková, M.; Budinská, N. and Zelenka, J. (2021), 'Astrotourism – Exceeding Limits of the Earth and Tourism Definitions?', *Sustainability,* volume 13(1), 373, DOI: https://doi.org/10.3390/su13010373.

26 Rodrigues, Á.; Correia Loureiro, S.M. C. and Prayag, G. (2022), 'The wow effect and behavioral intentions of tourists to astro-tourism experiences: Mediating effects of satisfaction', *International Journal of Tourism Research,* volume 24 (3), pp. 362–375, DOI: https://doi.org/10.1002/jtr.2507.

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These diverse travel motivations highlight the varied interests and desires of astrotourists, illustrating the multifaceted nature of astrotourism and its potentially broad appeal. Understanding these motivations is essential for developing targeted tourism experiences that meet the needs and expectations of more segmented astrotourist profiles:[27]

- **Scientific and amateur astronomers:** This group consists of individuals who have a deep interest in astronomy, including both professional scientists and amateur astronomers. They seek destinations with excellent observational conditions, such as clear skies and minimal light pollution, to conduct observations and studies. Depending on their skills and motivations, these individuals might participate in star parties and observatories, guided visits to deepen their understanding of cosmic events and meet like-minded people. They often bring their own telescopes and other equipment to enhance their experience, and they are generally willing to go further and pay more for adapted services and special infrastructure.

- **Cultural and historical enthusiasts:** These astrotourists are drawn to the cultural and historical aspects of astronomy. This profile visits ancient observatories and archaeological sites with astronomical significance and takes part in lectures on the history of astronomy. Their goal is to understand how different cultures have interpreted the cosmos throughout history.

- **Nature and landscape lovers:** This profile includes tourists who appreciate the natural beauty of dark skies and pristine landscapes. They travel to remote areas with minimal light pollution to enjoy the aesthetic and emotional experience of a star-filled sky. The integration of astronomical observation with other nature-based tourism activities like hiking and wildlife watching enhances their overall experience.

- **Educational and family groups:** These tourists seek destinations that offer educational programs and activities related to astronomy. They are often motivated by the desire to provide a learning experience for children and young adults, making astronomy approachable and engaging through hands-on activities and guided tours.

- **Spiritual and wellness seekers:** For some individuals, the experience of stargazing and contemplating the universe has a spiritual or meditative quality. They may travel to serene locations to find peace and inspiration under the night sky. This type of astrotourism is often linked with wellness and personal growth activities.

- **Photography enthusiasts:** Astrophotographers are a unique group of astrotourists motivated by the desire to capture the beauty of the night sky. They bring specialized equipment to capture high-quality images and often seek out destinations known for their exceptional visibility and minimal light pollution to photograph celestial objects, such as planets or galaxies, celestial events like auroras or meteor showers and nightscapes, i.e., iconic landmarks and landscapes under a starry sky.

Despite this diversity of astrotourist profiles, derived from their motivations, when one observes their behaviour in terms of priorities, purchase intentions or relative importance of astrotourism products in relation with other attractions, the astrotourists' profiles can be reduced to:

- **Astronomy enthusiasts:** Those who travel to particular sites specifically to witness celestial events or find the best quality night skies.

- **Casual astrotourists:** Those who engage in astrotourism activities as part of a broader holiday, sometimes by coincidence, if they happen to be present at a destination during an astronomical event or learn about a combined experience.

27 Baker, M.A. and Kim, K. (2020), 'The service experiencescape', in: Dixit, S. (ed.), *The Routledge Handbook of Tourism Experience Management and Marketing*, Routledge, London, pp. 150–158, DOI: https://doi.org/10.4324/9780429203916.

Table 3.1 **A conceptual model of the astronomy enthusiast and the casual astrotourist**

	Attitude	Experience	Behaviour
Enthusiast	Hobbyists motivated by space-related education and discovery. Seeking a quality dark place to observe.	Knowledge of space maps and the use of astronomical equipment.	Individuals who frequently gaze, either naturally or with scientific equipment. Spends more time looking at the stars and being in the dark.
Casual	Motivated by the sensory experience and the social belonging in the dark.	Lacks understanding of astronomy, tends to favour traditional sky narratives, dark sky viewing and leisure activities under the stars.	Looking at the sky as part of a broader holiday.

Source: Adapted from: Slater, D. (2020), 'Towards an Understanding of the Astro Tourist: A conceptual and Empirical Study', Ph.D. thesis, University of Central Lancashire, Preston, p. 246.

This simple division is however very interesting in terms of depicting two distinct segments of target markets. Understanding the motivations driving the consumption patterns of astrotourism is essential for developing targeted tourism experiences that meet the needs and expectations of different astrotourist profiles.

As shown in table 3.1, enthusiast astrotourists will be willing to travel further and to more isolated areas to find the darkest skies. They tend to be rather autonomous tourists, using their own equipment for stargazing. However, given the chance, they will often be willing to pay more for a premium guided experience or a collective activity like star parties and other amateur gatherings.

On the other hand, casual astrotourists will probably be more reluctant to booking an astrotourism experience for the first time and will be likely to enjoy astro experiences involving the starry sky or cosmic events with other attractions and products such as gastronomy, nocturnal hiking, archaeoastronomy or any form of art under starry skies. These casual astro tourists represent the bulk of the public, and therefore they embody the largest potential market to target.

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The Milky Way over a field of tajinastes (a Canary Islands endemic plant species) in La Palma, Spain. © Navarro, Enrique

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04
Marketing and communication

Abstract:
This chapter provides a guide to developing an effective marketing communication strategy in astrotourism. A well-crafted strategy aims to communicate unforgettable experiences, differentiate a destination, and establish an emotional connection with diverse astrotourist profiles. A key element is defining a unique value proposition (UVP) that highlights the destination's distinct qualities, such as pristine night skies and exclusive astronomical experiences. While traditional marketing remains relevant for visibility, digital marketing is essential – with content and channels tailored to specific audiences. Social media is particularly effective for casual astrotourists, while specialized forums and blogs engage astronomy enthusiasts. Customizing messages for different astrotourist profiles enhances engagement, while compelling night sky photography serves as a powerful tool to convey the uniqueness of the experience, generating interest and reinforcing the destination's identity as an astrotourism hub.

Key words: marketing communication | unique value proposition (UVP) | digital marketing | social media | astrotourist profiles | storytelling | night sky photography

Key message:
Effective marketing communication in astrotourism must have the consumer experience in a central position as well as adapt the message, language and channel to the target astrotourist profile and communicate evocative, shareable experiences. Measuring the results of a marketing strategy through SMART (specific, measurable, achievable, relevant and time-bound) objectives and key performance indicators (KPI) is highly recommended.

Llano del Jable lookout for stargazing in La Palma, Spain. © González, Antonio

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Marketing and communication are factors that greatly affect the motivation of tourists to visit a destination. In the tourism sector, communication is fundamental to creating customer awareness and value. The visitor experience is at the heart of the offering, making communication a key tool for attracting and retaining tourists.[28] In astrotourism the main objectives of a marketing and communication strategy are:[29]

- Positioning the destination as an astrotourism destination: Creating a solid identity that associates the destination with dark skies and a high-quality astrotourism offer.
- Creating an unforgettable experience: Experience and communication reinforce each other. A well-crafted message enhances attraction, while a memorable experience naturally generates compelling storytelling that draws more astrotourists and build a strong image.
- Attracting new visitors: Creating messages that not only inform but also inspire and connect emotionally with different profiles of astrotourists, or tourists potentially interested in this activity.



Starry landscape in the Ajuy ravine, within the Starlight Reserve of Fuerteventura, Spain. © de Saa, Carlos

28 Saefudin, I. (2022), 'Marketing Communication Strategy in Growing Visiting Motivation for New Tourists', *Journal of Positive School Psychology,* volume 6 (5), pp. 6227–6235.

29 Kotler, P.; Bowen, J.T. and Makens, J.C. (2016), *Marketing for Hospitality and Tourism*, 7th edition, Pearson India, pp. 174–278.

4.1 Crafting a captivating message

To develop a compelling message and storytelling, especially for astronomy enthusiasts, the following elements should be taken into account:

1. Unique value proposition (UVP)

A cornerstone of an effective communication strategy is defining a unique value proposition (UVP).[30] In the case of astrotourism, the UVP must emphasize what sets the destination apart:

- The quality of the night sky.
- The variety and uniqueness of astrotourism experiences.
- The existence of specialized infrastructures.[31]

2. Tourist experience

There is a two-way relationship between experience and communication: an unforgettable experience is easier to communicate, and good communication attracts more astrotourists.[32]

The emotions and sensations that tourists experience while observing the night sky are part of what connects them to the destination and makes it a truly memorable experience. These emotions – tranquillity, awe, spirituality – are further explained in chapter 3.

3. Language[33]

In general, language should be clear, simple and evocative, connecting emotionally with the audience and avoiding unnecessary technical jargon:

- Prior analysis: The goal is to identify the target audience for each message. Are they astronomy enthusiasts, families, or nature-oriented, casual astrotourists?
- Adapted vocabulary: Use terms and expressions should be relevant and familiar to the target audience: for astronomy enthusiasts, terms like “nebula” or “telescope” can be used.
- Interests and motivations: The message should be adapted to the interests and motivations of each segment of the audience: are they seeking an emotional or an educational experience?
- Call-to-action: Ending any communication content with an inspiring message entices the visitor to plan a visit.

30 Surrency, M. (2023), *Apply Value Proposition to Destination Marketing*, published on 12 April 2023, DigitalEdge, Jacksonville, available at: https://digitaledge.marketing [08-12-2025].

31 Wassenaar, A and Coetzee, (2024), ‘Global astrotourism initiatives and the applicability of their strengths, weaknesses, opportunities and threats to astrotourism in South African National Parks’, *Journal of Outdoor Recreation and Tourism*, volume 46, DOI: https://doi.org/10.1016/j.jort.2024.100766.

32 Pine II, B.J. and Gilmore, J. (2002), ‘The experience economy: work is theatre & every business a stage: goods and services are no longer enough’, *Journal of Revenue and Pricing Management*, volume 1.

33 Vieira, B.M.; Pinto Borges, A. and Pacheco Vieira, E. (2023), ‘The role of social networks for decision-making about tourism destinations’, International *Journal of Internet Marketing and Advertising*, volume 18 (1), pp. 1–27, DOI: 10.1504/IJIMA.2023.10053065.

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4.2 Choosing a pathway to reach the astrotourist

4.2.1 Digital marketing

Nowadays, two thirds of tourists research online before deciding on their destination.[34] Digital marketing is therefore a key strategy, where the channel, message and content should be adapted to every astrotourist profile:

The power of influencers

Influeners wield significant power in tourism digital marketing due to their ability to forge authentic connections with their audiences, which fosters trust and credibility in their recommendations. They can rapidly reach massive global audiences, often exceeding the impact of traditional marketing methods, though they can also cater to highly specific audience segments, allowing for targeted messaging to niche groups like nature lovers, astronomy enthusiasts or (astro) photographers. Their creation of visually appealing, high-quality content further inspires and generates interest in travel destinations, making them a very interesting option in the astrotourism marketing strategy.[a]

a) Zorlu, Ö. and Candan, T. (2023), 'The impact of social media influencers on destination preferences: a cross-generation comparison', Journal on Tourism, Leisure and Hospitality, volume 5 (1), pp. 53–61, DOI: https://doi.org/10.48119/toleho.1229922.

Table 4.1 **Main astrotourist profiles and preferred digital marketing channels**

Astrotourist profile	Channel	Ideal Content
Astrotourism enthusiast	Specialized forums and blogs (e.g., Cloudy Nights, The Sky Searchers, Sky & Telescope).	ISpecialized, more technical articles, astrophotography.
Casual astrotourist	Social media like Instagram and Tik Tok (e.g., @universetoday, @starwalkapp, @earthsky, @astrobiscuit).	Inspiring images and reels, news on astronomical events.

Source: Adapted from: Tourism Saskatchewan Canada (2022/2023), *A guide to astro tourism in Saskatchewan: Astrotourism market summary*, available at: https://edge.sitecorecloud.io/tourismsaskd098-tsaskxmcloud-tsaskxmclou0cba-4d1a/media/project/tourism-saskatchewan/business/pdf/astrotourism-market-summary.pdf [18-12-2025].

34 Vieira, B.M.; Pinto Borges, A. and Pacheco Vieira, E. (2023), 'The role of social networks for decision-making about tourism destinations', *International Journal of Internet Marketing and Advertising*, volume 18 (1), pp. 1–27, DOI: 10.1504/IJIMA.2023.10053065.

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4.2.2 Traditional marketing

While digital marketing has taken a centre role nowadays, traditional marketing remains a valuable tool. Public relations, printed materials, and partnerships with local tourism agencies can significantly enhance a destination's visibility.

Printed guides on dark skies, the best observation sites and celestial events can be effectively distributed at tourism offices and visitor hubs. Images of a starry sky or celestial event over an iconic landmark can be a compelling tool to attract astrotourists. A consistent marketing approach is essential, combining digital and traditional strategies to ensure a consistent brand image across all channels.



Starscape above sand dunes. © Fotiglobe | Dreamstime.com

4.3 Customizing communication strategies to different profiles

Table 4.2 **Customizing marketing communication strategy to different target astrotourists**

Astrotourist profile	Motivation	Message	Channels
Astrotourism enthusiast	Observe specific astronomical phenomena and improve astronomical knowledge and skills.	Showcase the scientific rigor and educational opportunities offered by the stargazing programs. Highlight the quality of the skies, access to specialized equipment, and the opportunity to participate in research activities. Provide technical details about observation conditions, dark sky certifications, and specific astronomical events.	Specialized forums, blogs and astronomy websites. Campaigns should include astrophotography images and offer access to workshops and specialized equipment.
Casual astrotourist	Connect with nature, relax under the stars, share a memorable experience.	Emphasize the sensory experience, tranquillity, connection to nature, and the opportunity to share the experience with friends and family. Enhance the stargazing experience with other attractions like landscapes or gastronomy.	Social media like Instagram and travel blogs. Short videos and inspiring photos showing families or friends enjoying clear skies.

Source: Adapted from Tourism Saskatchewan (2022/2023), A guide to astro tourism in Saskatchewan: Astrotourism market summary, available at: ttps://edge.sitecorecloud.io/tourismsaskd098-tsaskxmcloud-tsaskxmclou0cba-4d1a/media/project/tourism-saskatchewan/business/pdf/astrotourism-market-summary.pdf [18-12-2025].

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4.4 Night sky photography, a compelling tool for astrotourism marketing

Night sky photographs or videos can convey the magic of the astrotourism experience in a way that words cannot and they may be used in all communication channels, including tourism websites, social media, brochures, tourism guides and tourism fairs.

Night sky photography and videography have the potential to:

- **Convey a unique experience:** Images of starry skies over natural landscapes position the destination as unique and create an emotional connection with the viewer.
- **Generate interest to visit:** Striking images can ignite wanderlust and influence a tourist's destination choice.
- **Reinforce destination identity:** Starry skies or celestial events over iconic landmarks consolidate the destinations' image as a dark sky haven.

Key elements to portray in night sky photography are:

- **Quality dark skies:** Showcasing the quality of a destination's skies and the absence of light pollution.
- **Natural surroundings and landmarks:** Portraying iconic landmarks and natural landscapes under the beauty of a starry sky to showcase the unique identity of the place.
- **Astronomical events:** Photos or timelapses of auroras, meteor showers, or planetary conjunctions can be used in promotional campaigns, highlighting the destination's exclusivity (or suitability) for witnessing these events.

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The astrotourism campaign of New Zealand for casual astrotourists[a]

- **Creating UVP:** New Zealand blends nature and astronomy to create an immersive experience, and adds gourmet dining to reach a broader audience and attain a greater differentiation.
- **Crafting an emotional message:** The campaign emphasizes the sensory culinary experience, relaxation and connection to nature, while highlighting the social aspect of sharing with loved ones.
- **Matching the communication channels:** Utilizing social media platforms frequented by casual astro-tourists, like Instagram and travel blogs, with inspiring videos and photos.
- **Offering a memorable experience:** "*'Stargazing': The unique experience of enjoying New Zealand's stunning night skies while indulging in exceptional cuisine*".

a) Tourism New Zealand (2024), 'Tourism New Zealand off-peak strategy dishes up cuisine with a billion stars', press release published on 14 August 2024, available at: https://www.tourismnewzealand.com [25-09-2025].

4.5 Measuring results

To ensure the success of a communication strategy, it is important to set objectives and assess progress towards them through indicators.

Objectives should be SMART:[35]

- Specific: clearly defined;
- Measurable: progress and success must be quantifiable;
- Achievable: realistic, according to available data;
- Relevant: must contribute to the overall success of the destination; and
- Time-bound: with a clear deadline for completion.

Key performance indicators (KPI) are metrics used to evaluate whether (and to what extent) objectives are being met, and they allow for adjustments to be made when necessary.[36]

- **KPIs related to visibility and reach**, such as number of website visits or number of social media followers (e.g. an astrotourism destination tracks the increase on number of followers on their social media account after posting a time-lapse of a celestial phenomenon, as witnessed in their destination)
- **KPIs related to interaction**, such as email open rate, conversion rate of visits to bookings, comments and shares on social media (e.g. a tour company specializing in northern lights expeditions measures conversion rates, tracking how many website visitors book a guided tour after watching promotional videos).
- **KPIs related to reputation and positioning**, such as media mentions or ratings on review platforms (e.g. a hotel specialising in astrotourism monitors TripAdvisor and Google Reviews to maintain a 4.8-star rating, ensuring high visitor satisfaction and trust).

SMART objectives define what you want to achieve (e.g., increase destination visibility by 30%).

KPIs measure progress towards those objectives (e.g., number of visits to the destination's website).

35 Chaffey, D. (2025), 'How to define SMART marketing objectives (with example RACE KPIs)', published on 29 July 2025, Smart Insights, available at: www.smartinsights.com/goal-setting-evaluation/goals-kpis/define-smart-marketing-objectives/ [08-12-2025].

36 Bendle, N. T.; Farris, P.; Pfeifer, P.E. and Reibstein, D. (2009), *Marketing Metrics: The Manager's Guide to Measuring Marketing Performance*, 3rd edition, Pearson Education, New Jersey.

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05
Tourism, world heritage and night skies: archaeoastronomy over five continents

Abstract:
Recognizing the importance of sky observation throughout history for the development of all cultures and civilizations, UNESCO launched in 2004 the thematic Astronomy and World Heritage Initiative to identify exceptional sites related to archaeoastronomy, as well as preserve them and harness their potential as tourism attractions. This chapter showcases six emblematic examples of such sites from the five continents, highlighting the case of the Yucatan peninsula and the Maya archaeoastronomic heritage of Mexico. It also features the Dolmens of Antequera, Spain; Caral, Peru; Karnak, Egypt; the Nabatean cities of Petra and Hegra in Jordan and Saudi Arabia, respectively; and the island of Rapa Nui, Chile. All these archaeological sites demonstrate how ancient civilizations integrated their understanding of the cosmos and celestial phenomena into their cultural and architectural achievements and how this astronomical heritage can be leveraged to offer unique opportunities for astrotourism.

Key words: World Cultural and Natural Heritage sites | UNESCO | Astronomy and World Heritage Initiative | archaeology | archaeoastronomy | cultural astronomy | astronomical heritage.

Key message:
The UNESCO 2004 Astronomy and World Heritage Initiative recognizes heritage sites, objects and knowledge connected to astronomy around the world, establishing a link between science and culture and providing a valuable tourism resource.

Tulum Mayan city ruins, Mexico. © Lunamarina | Dreamstime.com

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The Convention Concerning the Protection of the World Cultural and Natural Heritage, adopted by UNESCO in 1972, highlights that certain sites on Earth hold outstanding universal value and are part of the shared heritage of humanity.[37] Among these sites listed in the UNESCO World Heritage List, there is a special but lesser known group: sites related to astronomy and the skyscape.

Considering that the observation of the firmament has represented an essential element in the development of all cultures and civilizations of the planet throughout time, in 2004, UNESCO launched the thematic Astronomy and World Heritage Initiative[38] to identify and promote sites with significant astronomical value. These sites represent the long-standing relationship of humanity with the cosmos, reflecting the development of astronomy across different civilizations and historical periods. The recognition of these places highlights their contribution to the understanding of astronomical knowledge, practices and observations. UNESCO's designation helps preserve and promote these sites, as well as advocate for preserving the quality of night skies, in line with efforts like the Starlight Declaration of 2007.

The UNESCO astronomical heritage sites are varied in nature, but can be classified, as shown in table 5.1, (i) in tangible immovable heritage, (ii) tangible movable heritage and (iii) intangible heritage.

Table 5.1 **Categories of astronomical heritage**

Value of the site	Categories of astronomical heritage		
	Tangible immovable heritage	**Tangible movable heritage**	**Intangible heritage**
Property/objects	▪ Architecture; ▪ Permanent constructions and structures; ▪ Fixed instruments.	▪ Plans; ▪ Movable artefacts; ▪ Movable instruments.	▪ Practical and/or technical expertise; ▪ Rules of use and maintenance; ▪ Structural or architectural history of the site.
Results of scientific activities (in the broadest sense)	▪ Stone carvings; ▪ Wall paintings; ▪ Iconography; ▪ Palaeography; ▪ Symbolic representations.	▪ Records or accounts of observations; ▪ Printed and digital data; ▪ Sky maps; ▪ Scientific publications.	▪ Knowledge and understanding; ▪ Calculations and theories.
Sociocultural applications and uses	▪ Astronomically aligned architecture; ▪ Light-and-shadow hierophanies; ▪ Urban planning and landscapes constructed using astronomy.	▪ Archives; ▪ Drawings; ▪ Maps and plans; ▪ Tools or instruments using astronomical properties (for example, sextants for maritime purposes or movable sundials in social use).	▪ Calendars; ▪ Ideology; ▪ Predictions of the future (whether rational or irrational from modern perspectives).

Source: United Nations Educational, Scientific and Cultural Organization (n.d.), 'Categories of astronomical heritage', UNESCO, Paris, available at: https://web.astronomicalheritage.net [08-12-2025].

37 United Nations Educational, Scientific and Cultural Organization (1972), *Convention concerning the protection of the world cultural and natural heritage*, UNESCO, Paris, available at: https://whc.unesco.org/en/documents/170665 [13-11-2025].

38 United Nations Educational, Scientific and Cultural Organization (n.d.), 'UNESCO's Astronomy and World Heritage Initiative (AWHI) and beyond', UNESCO, Paris, available at: https://web.astronomicalheritage.net [13-11-2025].

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However, while the diversity of UNESCO-recognized astronomical heritage sites scattered around the world is vast, this heritage is not yet sufficiently known to the general public. To illustrate this heritage and its potential for astrotourism, a selection of emblematic cases from the five continents was chosen, associated with immovable cultural heritage.

The cases analyzed in this publication constitute a selected sample of the extraordinary potential for knowledge and tourism of sites related to astronomy, showcasing the enormous opportunity to enrich the visitor experience with new visions and complementary ways of presenting these sites that have not yet been sufficiently explored.



El Caracol observatory structure at Chichen Itzá, Mexico. © Lucagal | Dreamstime.com

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5.1
Rapa Nui: a cosmos island – Easter Island, Chile

Rapa Nui (Easter Island) in Chile, also called Te Pito o Te Henua, is one of the most isolated inhabited places in the world. This remote land was first inhabited in 1250 and saw for the next five centuries the Rapanui, the inhabitants of Rapa Nui, develop their rich culture.

Over the years, a collaborative effort between astronomers and anthropologists has revealed the significance of Rapanui cultural astronomy on the island, particularly the relationship between land and sky in shaping their traditional culture. This partnership, drawing from archaeoastronomical fieldwork and ethnographic information, emphasizes the importance of asterisms like the Pleiades (Matariki) and Orion's Belt (Tautoru), which influenced Rapanui agricultural, religious and social activities. These celestial observations, led by skilled astronomer priests, were critical for determining seasonal cycles, including planting, harvesting and fishing.

More recent studies have reassessed previous findings and proposed that certain structures align with key celestial events, particularly the rising of the Pleiades and Orion's Belt, which were vital to Rapanui cosmology and timekeeping. They also identified rock carvings that may represent star maps, offering further insights into how the Rapanui interpreted their cosmos. These findings highlight the need to conserve both the land and skyscapes of Rapa Nui, as they hold universal value in understanding the cultural and astronomical heritage of the island.[39]



A *pukao*-crowned *moai* and *ahu* near the ceremonial centre at Tahai. The *ahu* is parallel to the coast and the moai is facing inland. © Belmonte, Juan Antonio.



The seven moai of Ahu A Kivi facing the sea and the helical setting of Tautoru (Orion's Belt), an astronomical event marking the New Year starting in the following new moon of the Rapa Nui calendar. © Lisastrachan | Dreamstime.com

39 Edwards, E.R. and Belmonte, J.A. (2004), 'Megalithic astronomy of Easter Island: A Reassessment', *Journal for the History of Astronomy,* volume 35 (4), pp. 421–433, DOI: https://doi.org/10.1177/002182860403500403.

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5.2
A landscape linked to the sky: Karnak, Egypt

Located in Upper Egypt, Ancient Thebes and its necropolis is a UNESCO World Heritage site inscribed in 1979, covering nearly 4.5 km^2 in the Qena Governorate. Thebes, known as Waset in ancient Egyptian, served as political capital of Egypt during the Middle and New Kingdoms, and as its religious capital for nearly 1,500 years. Key components of the site include the temples and palaces of Karnak and Luxor, as well as the Valley of the Kings and the Valley of the Queens, which highlight the peak of Egyptian civilization and its astronomical connections.

The temple of Amun at Karnak (Ipet Sut) exemplifies the relationship between the Nile landscape and the sky, showcasing significant landscape astronomy. Its temple complex features a symmetrical axis, reflecting a blend of astronomy, religion and history, marking it a sacred site. Although the entrance of the temple faces west toward the river, its axis is linked to the east, particularly to the sunrise.[40] Queen Hatshepsut constructed a temple oriented toward the sunrise at the winter solstice, aligning with the mythical and calendrical implications of this event.

Research has indicated that the winter solstice sunrise coincided with the New Year Feast during specific periods, notably around 2004 BCE when Mentuhotep II reunited Egypt.[41] This era also saw monumental construction at Karnak, with structures oriented toward the winter solstice sunrise, emphasizing its significance in Egyptian culture.

Additionally, the unique geographical setting of Ipet Sut, where the Nile flows downstream of the first cataract, creating a natural alignment with the solstitial lines, enhancing the sanctity of Thebes, particularly the Karnak area.[42] This relationship exemplifies landscape archaeology, integrating both terrestrial and celestial elements.

Constructions in Karnak were strategically built to align with both the Nile and the winter solstice sunrise, marking a solar milestone. This singularity endows the site with a unique cultural value and can be harnessed to attract visitors.



Sunrise on the winter solstice on the main axis of the temple of Karnak. © Belmonte, Juan Antonio

40 Barguet, P. (1962), *Le temple d'Amon-Re à Karnak*, l'Institut français d'archeologie orientale, Cairo.

41 Belmonte J.A.; Shaltout M. and Fekri M. (2009), 'Astronomy, landscape and symbolism: a study of the orientation of ancient Egyptian temples', in: Belmonte J. A., Shaltout M. (eds.), *In Search of Cosmic Order: Selected Essays on Egyptian Archeoastronomy*, Supreme Council of Antiquities Press, Cairo, pp. 213–285.

42 Belmonte, J.A. and Lull J. (2023), Astronomy of Ancient Egypt: A Cultural perspective, Springer Cham, DOI: https://doi.org/10.1007/978-3-031-11829-6.

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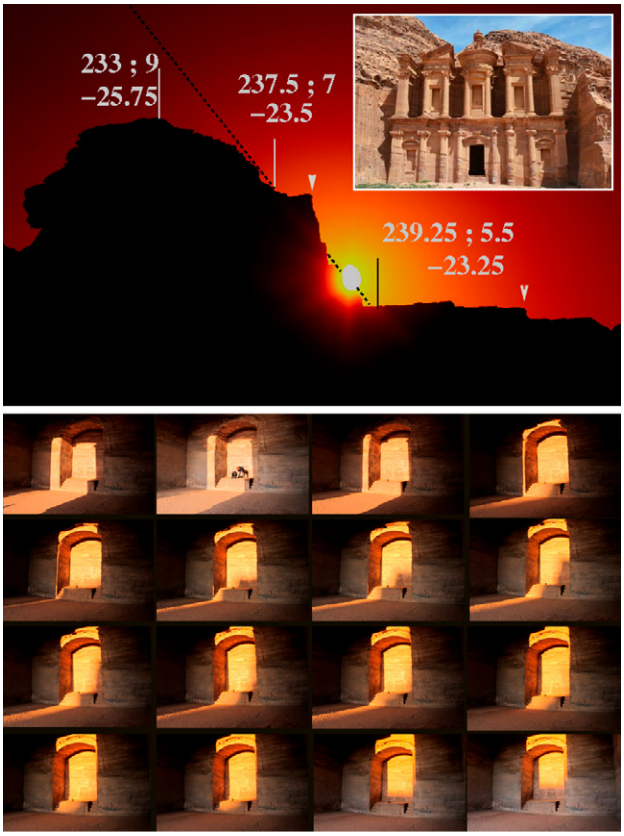
5.3
Nabataean Necropolis: the Asiatic rose cities of Petra and Hegra, Jordan and Saudi Arabia

Petra, Jordan

Petra, a UNESCO World Heritage site since 1985, is a remarkable Nabataean city located between the Red and Dead Seas. Known for its intricate rock-carved architecture and stunning natural landscapes, Petra, Jordan, was a significant hub for commercial trade along the incense route connecting ancient Arabia, Egypt, Syria and Phoenicia. The city features several notable monuments, including the Monastery (Ad Deir) and the Treasury, showcasing the heights of Nabataean civilization.

In recent years, a multidisciplinary team of researchers has revealed that many structures were intentionally aligned with key astronomical events such as equinoxes and the winter solstice. The Nabataeans frequently incorporated astronomical motifs into their architecture, reflecting the astral nature of their religion.[43]

Research has uncovered fascinating findings, such as light and shadow effects at the Monastery, which may relate to Nabataean mythology. The tomb of the Urn also exhibited alignments corresponding to solstitial and equinoctial events, possibly influencing its later designation as the cathedral of the city. Though the precise purpose of the Monastery remains uncertain, its alignment with the winter solstice suggests significant religious connections.[44]



Winter solstice sunset at The Monastery (Ad Deir, upper right inlet). The lower image shows the effect of light and shadow in the innermost sacred area of the structure. The upper image shows the solstice phenomenology associated with the western horizon where a double sunset occurred.
© Belmonte, Juan Antonio
and González-García, Antonio César.

43 Belmonte, J.A.; González-García, A.C. and Polcaro, A. (2013), 'Light and Shadows over Petra: Astronomy and Landscape in Nabataean Lands', *Nexus Network Journal*, volume 15 (3), pp. 497–501, DOI: https://doi.org/10.1007/s00004-013-0164-6.

Aviles, J.B.; González-García, A.C. and Rodriguez-Antón, A. (2019), *'Arabia Adquisita*: The Romanization of the Nabataean Cultic Calendar and the Tannur "Zodiac" Paradigm', in: Magli, G.; González-García, A.; Belmonte Aviles, J.; Antonello, E. (eds.), *Archaeoastronomy in the Roman World. Historical & Cultural Astronomy*, Springer Cham, DOI: https://doi.org/10.1007/978-3-319-97007-3_8

Belmonte, J.A.; González-García, A.C.; Rodríguez-Antón, A. and Perera Betancor, M.A. (2020), 'Equinox in Petra: Land- and Skyscape in the Nabataean Capital', Nexus Network Journal, volume 22, pp. 369–391, DOI: https://doi.org/10.1007/s00004-019-00464-1.

44 Healey, J.F. (2001, The Religion of the Nabataeans, Brill, Boston.

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Hegra, Saudi Arabia

In Saudi Arabia, the archaeological site of Hegra – considered the southern capital of the Nabataean Kingdom – features over 130 tombs carved from sandstone, with nearly 100 exhibiting monumental designs. Recent studies aimed to measure the orientations of these tombs, revealing systematic patterns that emphasize their relationship to the skyscape and the Nabataean lunisolar calendar that integrates religious festivals.[45]

Overall, the analysis of Petra and Hegra indicates a deliberate incorporation of astronomical events into Nabataean culture and religion, showcasing the civilizations' unique ability to harmonize their architectural designs with the surrounding landscape and celestial phenomena. Petra and Hegra exemplify a profound connection between human ingenuity and the natural world, achieved in an extraordinary manner. These findings underscore the cultural significance of the sites and highlight their potential for astrotourism.



Nearly twin façades of two tombs at the necropolis of Jabal Al Ahmar, both orientated close to due-south.
© Bennymarty | Dreamstime.com



Three tombs at the necropolis of Qasr Al Bint, orientated within the lunisolar arch.
© Belmonte, Juan Antonio

45 Belmonte, J.A.; González-García, A.C.; AlMushawh, M.; Urrutia-Aparicio, M. and Rodríguez-Antón, A. (2024), 'Land- and Skyscapes of Hegra: An Archeoastronomical Analysis of the Nabataean Necropolis', *Nexus Network Journal*, volume 26, pp. 275–305, DOI: https://doi.org/10.1007/s00004-024-00774-z.

5.4 Mayan archaeoastronomy in Yucatán, Mexico[46]

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The Yucatán Peninsula is home to one of the most advanced ancient civilizations: the Maya. While the Maya are often celebrated for their architectural feats, such as the great pyramids of Chichén Itzá and Uxmal, their achievements in the study of astronomy are equally remarkable. Archaeoastronomy in Yucatán, Mexico, plays a crucial role in understanding the relationship between the ancient Maya civilization and the cosmos. The Maya were expert observers of celestial bodies, with astronomy deeply integrated into their religious, agricultural and architectural practices. Archaeological sites in Yucatán reveal how the Maya used astronomical knowledge to orient their temples and structures, align their ceremonies with celestial events, and track time through sophisticated calendars.

For the Maya, astronomy was not just a science, but an essential component of their worldview and beliefs. The celestial bodies were linked to the gods and human destinies. For example, lunar cycles were associated with fertility and agriculture, while the movements of Venus and the Sun were related to war events and divine rituals. Mayan priests were responsible for interpreting the heavens and determining the timing of ceremonies, agricultural activities and even political decisions.

One of the most fascinating aspects of Mayan archaeoastronomy is how celestial events are encoded into their architecture. The alignment of temples with celestial events reinforced the power of the rulers, legitimizing their authority as divinely appointed. One of the best-known examples of this relationship is the Temple of Kukulcán at Chichén Itzá, popularly known as El Castillo (the castle). This pyramid is a monumental calendar, with four sides that have 91 steps each, totaling 364 steps. When the upper platform is included, it reaches 365, representing the number of days of the solar year. During the spring and autumn equinoxes, a visual phenomenon is observed in which a serpentine shadow appears to descend the north staircase, symbolizing the descent of the god Kukulcán (also known as Quetzalcoatl or the Feathered Serpent), from heaven to earth. This event demonstrates not only the architectural skill of the Maya, but also their advanced knowledge of solar movements and their importance in their cosmovision.

In addition to Chichén Itzá, other sites in Yucatán exhibit precise astronomical alignments. In Uxmal, an equally important Mayan city, the Pyramid of the Soothsayer (Pirámide del adivino) is oriented towards Venus, a planet of great significance in Mayan astronomy. The Maya believed Venus to be a celestial representation of Kukulcán, and its appearances were often correlated with military campaigns and important rituals. The Dresden Codex,[47] one of the few surviving Maya codices, contains detailed astronomical tables on the cycle of Venus.

A third site of great archaeoastronomy interest is Dzibilchaltún, near the Yucatán coast. At this site, the Temple of the Seven Dolls (Templo de las siete muñecas) is aligned with the rising of the Sun during the equinoxes. On these days, the Sun's rays pass directly through the

46 Aveni, A.F. (2001), Skywatchers: *A Revised and Updated Version of Skywatchers of Ancient Mexico*, University of Texas Press, Austin.
Sharer, R.J. and Taxler, L.P. (2005), *The Ancient Maya*, 6th edition, Stanford University Press, Redwood City.

47 The Saxon State and University Library (SLUB) in Dresden, Germany, is host to the Dresden Codex (or Codex Dresdensis) which dates from the 11th or 12th century. The hieroglyphic text contains astronomical and astrological tables, divination calendars, ritual instructions, and detailed drawings of Mayan gods. See: Encyclopedia Britannica (2025), 'Desden Codex', *Encyclopaedia Britannica*, Chicago, updated 28 October 2025, available at: https://www.britannica.com/topic/Dresden-Codex [13-11-2025].

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Equinox at the temple of Kukulcán, at Chichen Itzá archaeological site, Yucatán, Mexico.
© Consejo Consultivo Estatal de Turismo de Yucatán.

doors of the temple, creating an impressive visual effect that probably marks the beginning of a new season, a key time for agricultural activities.

Archaeoastronomy is also relevant on the Yucatán coast, where the Pueblo Mágico of Sisal (translated as Magic Village of Sisal) is located. Although this place does not have Mayan structures of the magnitude of Chichén Itzá or Uxmal, it is part of a region with a rich tradition of astronomical observation. The proximity of Sisal to the western horizon and its access to the sea make it a significant site for observing Venus as the evening star. The observation of this planet associated with critical events such as war and royalty, would have been essential for the ancient inhabitants of the region. Although there is no direct evidence of astronomical alignments at Sisal, its proximity to sites such as Dzibilchaltún suggests that the Maya living in this coastal area also integrated astronomy into their daily practices.

Whether inland or on the coast, all of these archaeoastronomical sites, as well as the extensive ancient Mayan knowledge and worldviews, provide Yucatán with a rich and distinctive heritage of great significance that can be leveraged to attract visitors offering them an authentic and unique experience. Nowadays, the State of Yucatán already counts on a series of signature astrotourism products based on the archaeoastronomical heritage of the region, such as:

- Equinox in Chichén Itzá:[48] On 20–21 March, as dusk begins to fall and the sun approaches the horizon, thousands of visitors enjoy the amazing spectacle of lights and shadows cast on one of the faces of the main pyramid.

48 Yucatán Travel (n.d.), *Región Ruta Puuc y Aldeas Mayas No. 355, Equinoccio en Chichén Itzá*, Yucatán Travel, Mérida, available at: https://yucatan.travel/experiencia/355-equinoccio-en-chichen-itza/ [08-10-2024].

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Noches de Kukulcán, a nightly light and sound show at the Chichen Itzá archaeological site, showcasing the history and legends of the Mayan civilization. © Consejo Consultivo Estatal de Turismo de Yucatán

- Astrotourism in Río Lagartos:[49] This experience takes place in the Río Lagartos Hotel located atop of a hill with a spectacular starry sky, and combines live traditional music, Yucatecan cuisine and a guided stargazing session.

- Video-mapping at Uxma:[50] This experience offers an immersive light show about the Mayan culture projected at Uxmal archaeological site.

- Nights at Kukulcán:[51] This experience let the visitor get deeper into Mayan culture through a spectacular light show at the most important sites of Chichén Itzá.

- Photography hunting night in Sisal:[52] Combining nocturnal wildlife watching and stargazing, this boat ride through the swamps of Sisal delights photography enthusiasts.

- Kayaking under the moonlight:[53] This experience offers a kayak tour through the mangroves of Chuburna Puerto, where visitors get to be in direct contact with nature and paddle under the full moon.

49 Yucatán Travel (n.d.), *Región Puerto Maya No. 252, Astroturismo en Río Lagartos*, Yucatán Travel, Mérida, available at: https://yucatan.travel/experiencia/252-astroturismo-en-rio-lagartos/ [08-10-2024].

50 Yucatán Travel (n.d.), *Región Ruta Puuc y Aldeas Mayas No. 245 Vive el VideoMapping Ecos de Uxmal,* Yucatán Travel, Mérida, available at: https://yucatan.travel/experiencia/245-vive-el-videomapping-ecos-de-uxmal/ [08-10-2024].

51 Yucatán Travel (n.d.), *Región Capital Mundo Maya No. 076 Noches De Kukulkán*, Yucatán Travel, Mérida, available at: https://yucatan.travel/experiencia/076-noches-de-kukulkan/ [08-10-2024].

52 Yucatán Travel (n.d.), *Región Riviera Yucatán No. 134, Noche de caza fotográfica en Sisal*, Yucatán Travel, Mérida, available at: https://yucatan.travel/experiencia/134-noche-de-caza-fotografica-en-sisal/ [08-10-2024].

53 Yucatán Travel (n.d.), *Región Riviera Yucatán No. 289, Remada bajo la luna*, Yucatán Travel, Mérida, available at: https://yucatan.travel/experiencia/289-remada-bajo-la-luna/ [08-10-2024].

5.5
Andean land and skyscapes, Peru

City of Caral

Caral, a 5000-year-old city in the Supe Valley, Peru, was first discovered in the early 2000s after being mistaken for natural hills by locals. Excavations revealed an exceptionally well-preserved city – among the oldest settlements in America – marked by large pyramidal stone platforms and semi-sunken circular plazas.

A pioneering study in 2021[54] revealed that the monumental structures of Caral were oriented in relation to both the Supe River and significant astronomical events, opening new insights into how the ancient inhabitants of the region understood time and space. The study found that the buildings of the city align either parallel or perpendicular to the Supe River, a phenomenon echoing similar independent developments in the Nile Valley of Egypt.[55] Furthermore, astronomical relationships played a crucial role in the layout of Caral. The most significant orientation was toward the southernmost moonrise during the June solstice, coinciding with major lunistice. This lunar cycle is aligned with the Andean rainy season and river floods, linking the Moon to agricultural and fishing cycles.

Caral represents the earliest known interaction between land and sky in pre-Columbian America, showcasing its universal value – although Caral is less famous than Inca or Moche cities, its archaeoastronomy findings highlight its potential as a key site for astrotourism.



From left to right, the so-called Pirámide Menor (the Lesser Pyramid), Pirámide de la Galería (the Gallery Pyramid) and Pirámide de la Huaca (the Huaca Pyramid) on the eastern edge of the great ceremonial plaza in the center of Caral.
© Belmonte, Juan Antonio



Sunken plaza of the Mayor Pyramid of Caral oriented perpendicular to the Supe River, Peru.
© Wirestock | Dreamstime.com

54 González-García, A.C.; Crispín, A.; Shady Solís, R.; Ricra, J.; Criado-Boado, F. and Belmonte, J.A. (2021), 'The River and the Sky: Astronomy and Topography in Caral Society, America's First Urban Centers', *Latin American Antiquity,* volume 32 (1), pp. 154–172, DOI: 10.1017/laq.2020.88.

55 Shady Solis, R. and Leyva, C. (eds. 2003), *La Ciudad Sagrada de Caral-Supe: Los Orígenes de la Civilización Andina y la Formación del Estado Prístino en el Antiguo Perú*, Proyecto Especial Arqueológico Caral-Supe/INC, Lima.

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Misminay

The Sacred Valley of the Incas is a diverse territoryin the shore of the Vilcanota river (Quechua Wilcamayu or "Río Sagrado") in the Cusco region, located in the south of Peru. Due to its rich ecological tiers, it served as the main supplier of food during the Incan empire, one of the most important civilizations in the Americas, who constructed imposing and grandiose feats of both architecture and engineering, of which have persisted and amazed the global populace, serving as the doorway to Machu Picchu, one of the Marvels of the World.

The architectural complex of Moray (found at 3,500 metres above mean sea level) is located in this vast territory. The complex is composed of circular units with concaving levels of circular platforms of which, according to studies on the site, served as the principal centre for investigation and agricultural experiments during the Incan time period.

Close to the compound, you can find Misminay, where you can find a breath-takingly colourful and fertile fields, along with an ideal place to observe the stars and learn about the Andean cosmovision. The wise inhabitants, who – as years went by – learnt how to best cultivate the land, inherited the agricultural knowledge and wisdom from past generations, achieving through the agricultural calendar the means to guide themselves using the constellations that are projected on the awe-inspiring Andean sky. Even in present day, with the objective of producing numerous products such as white corn, potatoes, coca and fruits, among many other examples, they were able to fulfil not only the needs of local communities, but those of a large portion of the Cusco region. For this reason, it was declared the first Starlight territory in Peru in the year 2023 (under the denomination Paraje Starlight).

Present Misminay contains two organizations composed of around 40 families, of the majority of which are young people and women within the community. For the past 15 years, they have promoted community-focussed tourism with the fervent purpose of "Re-invigorate and maintain present the traditions and wisdom of the forefathers in agriculture and their relationship with the astros", offering hikes to the Moray observatory, experiencing the Andean astronomy and promoting cultural exchanges with the visitors.

The value proposition of the experience includes observation and experimentation through the sightings and interpretation of Andean skies, agricultural practices, hikes towards the Moray observatory, mountain viewings, calendar readings, agriculture, artisanal texture workshops, mystical ceremonies, local Andean gastronomy, and rest stops in cozy residential houses – all under the care and management of the participating community.

Visitors are mainly comprised of travellers with a strong motivation for sustainability matters from Europe and the United States of America, typically travelling with their families, partners or friends. They look for authentic experiences that allow them to meaningfully connect with nature, the culture and the ancestral history of the places and communities they visit. They take special interest in astrotourism and archaeology and are in search of living a unique experience under the Andean sky, guided by the Incan cosmovision and the tales unique to those sacred surroundings. Additionally, in a complete local immersion, these visitors value the local gastronomy and the local produce.

The distinguishing elements, that characterize the unique touristic experience comes from:

- Moray Observatory: Strategically located, it offers impressive views of the stars, Sacred Mountains (apus) and the archaeological complex of Moray.
- Connection to the Andean cosmovision: Explore the skies through ancient folklore and the interpretation of the astros through the traditional view of the Incas.
- Night hikes: Experience the paths that allow for interaction with surrounding elements, illuminated by torches and accompanied by music.
- Interactive astrotourism: Local interpreters enrich the astrotourism experience, linked with the Andean tales and culture.

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- Local gastronomy: Taste the typical foods of the region, made by using local produce.

- Sustainability focus: Be always respectful and responsible with the surroundings and culture.

The community tourism in Misminay is backed by both public and private contributors that bring technical support and continuous assistance to the community. One of the most present is the Ministry of Foreign Commerce and Tourism, through the Estrategia Nacional de Turismo Comunitario (National Community-based Tourism Strategy), which has brought improvements to the quality, innovation and positioning of community tourism, along with strengthening the organization in its ability to participate and actively manage tourism in the region. CondorTravel has been an important strategic commerce partner that has helped in projecting this kind of travelling to different markets, all under a sustainable focus. All of these collaborations are in the pursuit of the end goal of guaranteeing the active participation of local communities and to benefit the conservation of the land. Within these main benefits of increased touristic activities, it can be highlighted that:

- The conservation of the space, paths and natural resources is brought to the forefront;

- The cultural and intrinsic value of the local culture are strengthened;

- Collective and associative work is fostered under this initiative

- It empowers women and encourages active participation in the organization;

- It preserves the know-hows and wisdom of local inhabitants (Andean cosmovision and the folklore associated) allowing for the new generations to enrich themselves and dive into the local heritage; and

- It impulses employment opportunities for the community, by providing of tourism services (such as guides of the region, gastronomy and lodgings), as well as by cultivating local foods, benefitting local farmers and contributing to the improvement of the quality of life for the local residents.

Location:

- Region: Cusco
- Province: Urubamba
- District: Maras
- Recommended time of the experience: full day
- Altitude: 3,700 metres above sea level
- Recommended season: April to October
- Rainy months: November to March
- Temperature: Max. 20° C, min. 0° C
- Main attraction destination: Moray Archaeological Complex



One Andean Sky" – Mullakas Misminay Community, Peru. © Velasco, Luis

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5.6 Megalithic archaeoastronomy: the Dolmens of Antequera, Spain

The Conjunto Arqueológico Dólmenes de Antequera (CADA) (the dolmens of Antequera archaeological compound, also known as Dolmens of Antequera) is a UNESCO World Heritage Site since 2016 and consists of three megalithic monuments: the dolmens of Menga and Viera, and the tholos of El Romeral, all of which showcase different architectural styles from the Neolithic and Bronze Age. Located in the province of Málaga in southern Spain, these structures are part of a larger cultural landscape that includes two natural landmarks, Peña de los Enamorados and the Torcal de Antequera. Together, they form a unique prehistoric complex where the relationship between land and sky plays a significant role.

The Viera dolmen is aligned with the equinoxes, allowing sunlight or moonlight to illuminate the interior.[56] The Menga dolmen, the most impressive of all, has a singular orientation towards the Peña de los Enamorados, possibly connected to lunar alignments. This mountain holds mythological significance for the people of Antequera, resembling the face of a sleeping giant. The El Romeral tholos features a sophisticated false dome and is designed to reflect the winter solstice sunlight, creating a dramatic interplay of light and shadow inside the tomb. It is oriented toward the Torcal de Antequera, arguably the most impressive karstic landscape in Europe.

The complex demonstrates how ancient civilizations integrated their understanding of the cosmos into their cultural and architectural achievements. Attracting over 160,000 visitors in 2023,[57] these alignments between the monuments, the landscape, and the skyscape make Antequera a prime example of astrotourism, on par with renowned sites like Stonehenge and Newgrange.



In clockwise sense: (i) the dolmen of Menga, oriented to Peña de los Enamorados and perhaps to the major lunistice. (ii) The dolmen of Viera, 'equinoctially' aligned either to the Sun (top) or the Moon (bottom). (iii) The winter solstice sunlight entering the tholos of El Romeral. © Conjunto Arqueológico Dólmenes de Antequera – CADA.

56 Belmonte, J.A. and Hoskin, M. (2002), *Reflejo del Cosmos: Atlas de Arqueoastronomía del Mediterráneo Antiguo*, Equipo Sirius, Madrid.

57 Núñez, A. (2024), 'Más de 160.000 visitas en los Dólmenes de Antequera en 2023', *Clave Económica*, published on 12 January 2024, Ayuntamiento de Antequera, Antequera, available at: https://claveeconomica.es/160000-visitas-dolmenes-de-antequera-2023/ [08-12-2025].



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06
Other related tourism products and experiences

Abstract:

This chapter explores the diverse range of experiences that extend beyond nocturnal stargazing and can be integrated into astrotourism. Celestial and atmospheric events, as well as combinations with other attractions, create unique offerings that appeal to different tourist profiles. Eclipses draw large crowds eager to witness these rare astronomical phenomena, while aurora chasing has grown in popularity due to the mesmerizing nature of the northern lights.

Astrotourism can also be combined with other experiences to enhance its appeal. G-astronomy, which merges astronomy with gastronomy, offers a culturally rich experience where culinary activities take place under the stars, supported by compelling storytelling. Nature-based tourism pairs well with astrotourism, with activities such as night-time hiking, horseback riding, birdwatching or nocturnal wildlife observation catering to nature-focussed travellers. Similarly, palaeontology and astrotourism create an engaging combination for science-oriented visitors interested in the history of Earth and its connection to the cosmos.

Key words: aurora | eclipse | nature-based tourism | g-astronomy | paleontology.

Key message:

The diversity of experiences that fall under the category of astrotourism is remarkable, including celestial phenomena like eclipses and auroras, and combined experiences like g-astronomy, nature-based activities and paleontological tourism. These offerings cater to diverse tourist profiles seeking unique, culturally rich and nature-focussed experiences.

Dolmens in western Tunisia. © Khaled Ladjimi | Dreamstime.com

6.1 Auroras

Auroras – known as Aurora Borealis or northern lights in the northern hemisphere, and Aurora Australis in the southern hemisphere – are a driver of tourism given the awe-inspiring experience of witnessing these spectacular natural light displays in the sky. These stunning phenomena are caused by the interaction of solar winds with the magnetic field of the Earth and its atmosphere, resulting in vivid colours and patterns in the sky, especially in polar regions. Popular destinations for witnessing auroras include Norway, Sweden, Finland, Canada, Iceland and Alaska in the United States of America, all of which offer optimal conditions to find auroras due to their geographic location.[58]

Though auroras occur all year round, the best season for chasing auroras runs from mid-September through March, when the long nights in the northern hemisphere provide ample aurora viewing opportunities. But, as with many natural phenomena, auroras are temporally and spatially discontinuous, and somewhat difficult to forecast, hence the inherent risk for the provision of a stable tourism product.[59] Given this uncertainty, diversification is key: this form of tourism often includes guided tours, where experts 'hunt' auroras at night and provide information on the science behind them, along with diurnal complementary activities such as dog sledding and snowmobiling.

While it represented a marginal niche product in the late 20th century, aurora-based tourism has grown significantly over the last decade, especially in the northern regions where it has been promoted to help address seasonality issues. Interestingly, it has become a large-scale type of tourism nowadays, attracting all sorts of tourist profiles who are motivated not only by the scientific value but the otherworldly, spellbinding side to the experience.[60]

58 Pásková, M.; Budinská, N. and Zelenka, J. (2021), 'Astrotourism – Exceeding Limits of the Earth and Tourism Definitions?', Sustainability, volume 13(1), 373, DOI: https://doi.org/10.3390/su13010373.

59 Heimtun, B. and Lovelock, B. (2017), 'Communicating paradox: Uncertainty and the northern lights', Tourism Management, volume 61, pp. 63–69, DOI: https://doi.org/10.1016/j.tourman.2017.01.017.

60 Heimtun, B. and Haug, B. (2022), 'The development of the northern lights tourism network', Annals of Tourism Research Empirical Insights, volume 3 (1), https://doi.org/10.1016/j.annale.2021.100031.

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Auroras – a booming sector[a]

Chasing auroras has evolved from a niche interest into a booming tourism option. Countries within or near the Arctic Circle are experiencing a significant boost in tourism due to auroras. Recent data reveals remarkable growth in accommodation and travel metrics in these regions, reflecting a 217% increase in Arctic Circle stays in Nordic countries between 2009 and 2016.

With the solar maximum (highest rate of solar activity during the approximately 11-year solar cycle) occurring between 2024 and 2025 when auroras are expected to be especially frequent and intense, countries like Finland and Norway have seen a significant rise in searches and bookings, partly supported by increasing investment in local infrastructure and services to cater to the rising number of visitors. The Lapland region of Finland is witnessing a 370% increase in hotel searches, while Tromsø in Norway, often dubbed the Capital of the Northern Lights, is experiencing a tourism revival, with a yearly 10% rise in revenue and a significant increase in the number of international guests.

At a global scale, the global size of the northern lights tourism market was estimated at USD 834.5 million in 2023 and is projected to grow at a compound annual growth rate of 9.8% from 2024 to 2030.

a) Grand View Research (2024), 'Northern Lights Tourism Market To Reach $1,647.9Mn By 2030', press release published in August 2024, GVR, San Francisco, available at: https://www.grandviewresearch.com/press-release/global-northern-lights-tourism-market [08-12-2025].

The full report is available at: Grand View Research (2024), *Northern Lights Tourism Market (2025–2030)*, GVR, San Francisco, available at: https://www.grandviewresearch.com [08-12-2025].

Auroras over a Nordic landscape. © Dijkstra, Stijn



6.2 Eclipses

Eclipses have fostered a unique travel niche where enthusiasts traverse the globe to witness solar and lunar eclipses. This phenomenon has grown significantly over recent years, driven by the rare and spectacular nature of these celestial events.[61]

Though some authors describe up to four types of observable eclipses, including solar, annular, lunar and hybrid eclipses, not all eclipses are equally interesting for the public.[62] Solar eclipses, where the Moon appears to cover the Sun and creates a dramatic display of the Sun's corona, are the rarest and most popular. These events occur approximately every 18 months, but the path of totality, where the eclipse is visible in its full glory, is narrow, about 270 km wide. This rarity and the need to be in specific locations have led to the rise of this type of tourism, with travellers often planning years in advance to secure accommodations and travel arrangements in optimal viewing spots.

The United States of America have a long history of eclipse events that draw millions of visitors, such as the so-called Great American Eclipse in 2017 or the total solar eclipse in 2024. During these events, hotels, campsites and other accommodations reported full bookings, and many States in the path of a total eclipse saw substantial increases in tourism revenue. Another example is the total solar eclipse 2026 in Spain, referred to as the Grand Spanish Eclipse 2026.

The potential of an eclipse to generate a large-scale tourism occasion is determined by the easiness to reach and the hosting capacity of the area within the path of totality hence the need of these destinations to devote efforts to planning the access, transportation, accommodation and other services these events require, years ahead.[63]

The allure of witnessing an eclipse lies not only in the spectacle itself or the scientific interest, but also in the sense of community and shared experience among viewers: eclipses attract tourists of every profile and motivation. Many travellers describe these events as profoundly moving, often describing the eerie twilight during a solar eclipse as otherworldly and unforgettable.[64] As interest in astronomical events grows, the popularity of eclipses is likely to continue its rise.

61 Artuner Özder, C. G. (2024), *Astro-tourism: a growing niche of sustainable tourism*, Detay Yayincilik, Ankara.

62 Pásková, M.; Budinská, N. and Zelenka, J. (2021), 'Astrotourism – Exceeding Limits of the Earth and Tourism Definitions?', Sustainability, volume 13(1), 373, DOI: https://doi.org/10.3390/su13010373.

63 Kunjaya, C.; Melany, A.A.; Sukmaraga, A. and Arsono, T. (2019), 'Possibility of astronomical phenomena to be used to support tourism industry', Journal of Physics: Conference Series, 1231, DOI: 10.1088/1742-6596/1231/1/012025.

64 Greenwald, J. (2017), 'Why Chasing a Total Solar Eclipse Is a Truly Awesome Experience', published on 11 August 2017, AFAR, available at: https://www.afar.com/magazine/why-chasing-a-total-solar-eclipse-is-a-truly-awesome-experience [08-12-2025].

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The Great American Eclipses

The so-called Great American Eclipse 2017 was a perfect demonstration of how natural phenomena like solar eclipses can turn into large-scale tourism events, providing significant economic profit. This event had a significant economic impact in several States and towns within the path of totality: in Nebraska alone, it drew more than 700,000 visitors and generated over USD 127 million, becoming the greatest single tourist event on record in Nebraska, while South Carolina reached USD 267 million. In Oregon, towns like Madras had hotels, campsites and other accommodations fully booked months in advance and had their population increase 16-fold.[a]

More recently, the total solar eclipse that took place in April 2024 also had a remarkable economic impact: in Indiana alone, the event attracted over 3.5 million visitors and generated USD 140 million revenue, providing over a 41.1% boost to regular visitor spending.[b]

a) Eclipse Resources (2017), 'Impact Data from the 2017', Solar Eclipse Task Force, American Astronomical Society, available at: https://eclipse2024resources.com [08-12-2025].

b) Gay, D. (2024), 'Study: Indiana generates $148 million in economic impact during April's total eclipse', published on 24 June 2024, MyWabashValley.com, available at: www.mywabashvalley.com/news/local-news/study-indiana-generates-148-million-in-economic-impact-during-aprils-total-eclipse/ [08-12-2025].



The Moment of Solar Eclipse Festival 2016. Central Sulawesi, Indonesia. © Yosua Marunduh | Dreamstime.com

6.3 G-Astronomy

In many cultures, food and astronomy are closely linked through myths and traditions. As an example, the Pleiades star cluster, often referred to as the Seven Sisters, has culinary legends connected to it in various societies. In the Mediterranean, the appearance of the Pleiades signaled the start of the olive harvest, while in Japan, the Tanabata festival celebrates the meeting of the stars Vega and Altair with traditional foods like *somen* noodles.

The relationship between astronomy and gastronomy has reached the academia: one creative approach to merging food and astronomy comes from an astrophysicist who uses culinary metaphors to explain complex astronomical concepts. For example, a focaccia is used to represent the expansion of the universe, and edible planets are created using spherification techniques.[65]

Likewise, the sensory experience of food has been shown to enhance the understanding of astronomical concepts. For instance, layers in a dish can illustrate the stratification of the universe, while varying textures can symbolize different cosmic phenomena. This method not only stimulates the senses but also helps reinforce scientific ideas.[66]

The combination of astronomy and gastronomy offers a novel way to communicate complex scientific principles, making learning both enjoyable and effective. Consequently, merging stargazing and food and drink tasting has become one of the most popular astrotourism experiences, especially among casual astro tourists.

From wine-tasting under the moon in La Palma, Spain (where the world's first Starlight Winery can be found), to Stargrazing in New Zealand (further details of this campaign are provided in chapter 4),[67] pairing stars with a culinary experience is one of the growing experiences in astrotourism destinations around the world.

65 El Contribuyente (2017), 'Cómo la astronomía y la gastronomía hacen buen maridaje para explicar el Universo', published on 25 April 2017, El Contribuyente, Mexico City, available at: https://www.elcontribuyente.mx [08-12-2025].

66 Trotta, R. (2017), 'Where Astronomy and Gastronomy Meet', published on 25 April 2017, *Scientific American*, available at: www.scientificamerican.com/blog/guest-blog/where-astronomy-and-gastronomy-meet/ [08-12-2025].

67 Shao, W. (2024), '"Stargrazing": Canterbury set to shine with new campaign promoting star tourism and food', The Press, published on 8 December 2024, available at: www.thepress.co.nz/nz-news/350378069/stargrazing-canterbury-set-shine-new-campaign-promoting-star-tourism-and-food [08-12-2025].

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G-astronomy at one of Paradores' (Spanish state-owned hotel network) restaurants, featuring this Solar System, a dish based on bluefin tuna and egg. © Paradores

TStars + tastes – g-astronomy in Ávila, Spain[a]

Stellarium Ávila – the astrotourism brand of the Spanish province of Ávila – has created *Stars + tastes*. Through the motto *Ávila feels the stars + tastes,* this claim encompasses a wide array of tourism products blending the world-class cuisine and gastronomy of the province and its excellent dark skies, creating unique experiences for the astrotourist:
Maridaje Estelar includes all experiences featuring wine tasting, visiting wineries and guided stargazing, while *Setas y estrellas* (mushrooms and stars) encloses different activities consisting of mushroom foraging workshops followed by a guided stargazing session at night. Under the name G-Astro experiences, some other special products uniquely blend wine tasting with haute cuisine and a guided tour through the night sky.

a) Stellarium Ávila (n.d.), 'Stars + tastes', Diputación de Ávila, available at: https://www.stellariumavila.es/en_US/experiencias/estrellas-sabores [08-12-2025].

6.4 Nature and astrotourism

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Astrotourism and nature-based tourism are deeply intertwined – in fact, some authors categorize astrotourism as a subproduct within nature-based tourism.[68] Both focus on natural experiences, appeal to a similar type of tourist, take place in natural, often protected areas and show comparable benefits in terms of rural sustainable development and environmental conservation.

Astrotourism ideally takes place in areas where the sky is darkest, corresponding with pristine environments with minimal light pollution and human presence, often designated natural protected areas. Moreover, nature-based tourism and astrotourism are demanded by a similar tourist profile, with common motivations. This type of tourist typically seeks to escape urban environments and engage in outdoor activities: Experiences show that, when given the opportunity, they are eager to enjoy a naturally dark night sky and to learn about nocturnal wildlife.[69]

Both sectors also show shared values and impact: by drawing tourists to often remote or rural areas, both types of tourism can boost local economies. Likewise, sustainability is a key component, with both promoting responsible tourism practices, encouraging nature conservation and valuating sensitization and education purposes.

Given their shared space, target audience and motivations, these two tourism products are both combinatory and complementary, embodying a perfect match through different integrated experiences:

1. Combined nature tours: these usually include daytime activities like hiking, horse-riding or wildlife watching (especially at dusk), followed by guided stargazing sessions, allowing visitors to experience the transition from day to night and appreciate both the terrestrial and celestial beauty. Given the duration, these packages often include dinner service.

2. Astronomy and geology: geoparks, usually protected areas showing singular geological features, pair well with astrotourism activities. These natural spots not only have pristine, dark skies to enjoy, but offer a unique environment to do so, and a storytelling that is easily linkable with astronomy: the history and evolution of our planet within the bigger universe.

3. Birdwatching and astrotourism: this comprises a separate category since both activities share a common tourist profile with certain observational skills and specialized equipment. Proof of the success of this combination is the LookUp EU-funded project, aimed at rediscovering the value of our skies by supporting tourism businesses based on astronomy and birdwatching.[70]

68 Soleimani, S. et al. (2019), 'Astro-tourism conceptualization as special-interest tourism (SIT) field: a phenomenological approach', *Current Issues in Tourism*, volume 22 (18), pp. 2299–2314, DOI: https://doi.org/10.1080/13683500.2018.1444021.

Falk, M.; Tveteraas, S.L. and Xie, J. (2020). '20 years of Nordic tourism economics research: a review and future research agenda', *Scandinavian Journal of Hospitality and Tourism*, volume 21 (1), pp. 78–90. DOI: https://doi.org/10.1080/15022250.2020.1833363.

69 Welch, D. et al. (2024), The world at night: Preserving natural darkness for heritage conservation and night sky appreciation, IUCN WCPA Good Practice Guidelines Series No. 33, International Union for Conservation of Nature, Gland, p. 87.

70 LookUp (n.d.), 'Supporting Tourism SMEs Triple Transition by Uncovering the Value of Sky as Destination', LookUp, Madrid, available at: https://lookupthesky.eu/ [08-12-2025].

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Trails and stars in Colombia

Recognized as a biodiversity hotspot in the world, Colombia is a prime destination for nature enthusiasts. Colombia is one of the most biodiverse countries in the world, featuring a range of ecosystems, including tropical rainforests, snow-capped volcano, Caribbean beaches and paramos (high-altitude wetlands). These landscapes are home to a vast array of wildlife – including more than 1,900 species of birds such as the Andean condor, countless plant species and unique mammals like the spectacled bear – and to culturally-rich local communities. These landscapes offer endless tourism opportunities for hiking, canoeing, birdwatching and climbing.

In the last years, quality dark skies in Colombia have been leveraged to merge this natural heritage, in the form of unique experiences for the visitor. The Tatacoa desert is one of the regions where astrotourism and nature-based activities are merged to offer the visitor an immersive experience of this majestic desert.[a]

Other examples can be found in areas closer to cities. In the outskirts of Bogotá visitors can enjoy a memorable experience through a hiking tour towards a sacred place where local Muisca indigenous guides offer a stargazing activity blending scientific and indigenous knowledge of the sky.[b]

a) El Desierto de La Tatacoa (n.d.), *Astronomía en el Desierto de La Tatacoa* (n.d.) available at: https://www.eldesiertodelatatacoa.com [08-12-2025].

b) Esariri (n.d.), 'Discover one of the best places to see the stars while hiking in Bogotá, guided by astronomers and Muisca indigenous people.', Esariri, available at: https://www.esariri.com/Experiencia/senderismo-en-bogota-con-los-muiscas/ [12-09-2024].



Starry sky over the Tatacoa Desert (Colombia), Starlight Tourist Destination. © Lozano, Yilver

6.5 Paleontology and astrotourism

Paleontological tourism is a type of scientific tourism related to geology and the history of life on Earth that usually takes place on excavation sites or fossil-rich geological parks and areas.[71]

Scientific tourism refers to travel experiences in which scientific knowledge, methods or activities shape the visitor experience – whether through guided learning, exploration, or participation in research – fostering education, discovery and responsible engagement with natural or cultural environments.[72]

Therefore, paleontological tourism and astrotourism share some common tourist profiles: scientific and cultural enthusiasts motivated by learning and that enjoy educational and interactive experiences that make learning memorable, especially for the younger public.

Moreover, the combination of paleontology and astronomy taps into the mysteries of the origins of the Earth and prehistoric life, offering insights into geological formations and the evolution of the planet, as well as access to paleontological sites where visitors can learn about prehistoric creatures.

Merging astronomy and paleontology is therefore a strategy for destinations to stand out in the market, create a unique product offering and increase its appeal to niche tourism markets interested in science.



Night sky in the Provincial Park Ischigualasto, San Juan, Argentina. © Provincial Park Ischigualasto, San Juan

71 Antczak, M. (2020), 'Are fossils enough? Palaeontological tourism based on local dinosaur discoveries', Geography and Tourism, volume 8 (2), pp. 15–27, DOI: 10.36122/GAT20200812.

72 Mao, P. and Bourlon, F. (2011), 'Le tourisme scientifique: un essai de définition', Téoros, volume 30 (2), pp. 94–104, available at: http://journals.openedition.org/teoros/1926.

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Paleontology and astrotourism in Argentina

In Argentina, astrotourism has gained significant traction, presumably fostered by a national programme aimed at developing and promoting nature-based tourism in the country. Named the National Capital of Astronomical Tourism, San Juan is the leading province for astrotourism, followed by 13 provinces and Buenos Aires City identified as astrotourism destinations, all of which treasure naturally dark skies and other complementary natural attractions.

However, paleontology is the differentiating factor making Argentina a unique astrotourism destination. Renowned for its rich paleontological heritage, Argentina is home to notable sites ripe with fossils of prehistoric creatures, that represent a valuable tourism attraction. Combining astrotourism with paleontological activities give place to unique experiences that cater the interest of visitors with a common curiosity about the history of our planet.

A noteworthy example is Chaco. This province is home to Campo del Cielo – Reserva Natural Cultural Pigüen N'Onaxá, a natural protected area known for its meteorite falls and craters that attracts visitors eager to witness these remnants from space. Additionally, the province of Chubut, rich in both ancient fossils and dark skies, offers night sky, fossil and astrophotography tours in unique protected areas like the Petrified Forest of Sarmiento or Piedra Parada, merging the wonders of the universe with the history of life on Earth.

The city of Trelew offers another interesting example of the fusion of paleontology and astrotourism. The Egidio Feruglio Paleontological Museum, scientifically and internationally recognized, displays numerous dinosaur specimens and houses over 40,000 fossils from Patagonia. The Astronomical Center features an outdoor theme park and two observatories (one for night-time and another for solar observations) to explore the Patagonian sky, both from a scientific perspective and through the worldview of the Indigenous Peoples.



Egidio Feruglio Paleontological Museum in Trelew, Chubut, Argentina. © Egidio Feruglio Paleontological Museum, Trelew



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07 Accessibility and inclusion

Abstract:

UN Tourism – in collaboration with representatives of organizations of people with disabilities – has issued a series of technical manuals and guidelines since 2010. UN Tourism also led the development of the first international standard (ISO 21902:2021) on accessible tourism in the world, published in 2021. Prioritizing accessibility is both a matter of human rights and a strategic opportunity to increase demand, foster inclusion and differentiate destinations. Astrotourism can become a leading example of how innovation and universal design can create experiences for all. This chapter offers guidelines on how to implement accessibility practices in astrotourism according to the different types of disability: physical, intellectual and sensory disabilities. mpelling night sky photography serves as a powerful tool to convey the uniqueness of the experience, generating interest and reinforcing the destination's identity as an astrotourism hub.

Key words: accessibility | accessible tourism | physical disability | intellectual disability | sensory disability

Key message:

Making tourism accessible nowadays is a matter of equality but also an opportunity for destinations. The astrotourism sector must take into consideration adopting accessibility practices and measures adapted to every type of disability or impairment.

10t May 2013 partial solar eclipse seen along the Indian Ocean and the Pacific.
© Agung Angkawijaya | Dreamstime.com

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The World Health Organization estimates 1.3 billion people – about 16% of the global population – experience significant disability in (2023). According to UN Tourism, accessibility to all tourism facilities, products and services should be a central part of any responsible and sustainable tourism policy.

Accessible tourism involves a collaborative process among stakeholders that enables people with access requirements, including mobility, vision, hearing and cognitive dimensions of access, to function independently, with equity and dignity through the delivery of universally designed tourism products, services and environments.[73]

In fact, in 2021, UN Tourism, the Fundación ONCE and UNE (Una Norma Española – Spanish Association for Standardization) led the development of a pioneering, cross-cutting standard on an international level: the first standard on accessible tourism in the world, ISO 21902:2021 Tourism and related services – Accessible tourism for all – Requirements and recommendations, offering guidelines to ensure access and enjoyment of tourism for all on an equal basis.[74]

By prioritizing accessibility, destinations can ensure that individuals with disabilities, older people and families with young children can fully enjoy tourism experiences. Inclusive practices not only enhance the quality of visits but also promote diversity, encouraging a richer cultural and intergenerational exchange in the context of tourist experience. Additionally, accessibility initiatives can stimulate local economies by attracting a broader audience, increasing revenues for business providers and attaining greater product differentiation across the different seasons of the year. Creating accessible tourism experiences reflects a commitment to social responsibility and human rights, allowing everyone to explore and appreciate the beauty and uniqueness of different destinations without barriers. Moreover, if done from the planning phase, investment costs derived from adopting inclusive practices can be kept to a minimum.[75]

Astrotourism destinations and tourism stakeholders should ensure astrotourism activities are inclusive and accessible to anyone with a disability or specific access requirements, as well as adapted for each type of end-users.

Following recommendations can be applied generally for an activity to be inclusive and accessible to all profiles:

- Provide information in detail beforehand to end-users, their caregivers and families, as well as educators about the activity, such as its content, the environment in which it is being rolled out, its duration, equipment and materials.
- Inform in advance about the lack or excess of light during the activity (if applicable).
- Inquire about potential impacts of certain activities that may cause discomfort or stress for visitors with certain types of disabilities, especially neuro-divergence.
- Communicate directly with individuals with disabilities and allow them time to ask questions and receive adequate information before turning to family members for further assistance.
- Harness the potential of virtual reality (VR) to provide immersive multisensory experiences, customized to ensure accessibility for diverse cognitive, sensory and specific access requirements.

New technologies such as virtual reality, haptic feedback, AI-powered interpretation and 3D printing offer unprecedented opportunities to enhance inclusion. These tools allow for immersive experiences tailored to various access needs, expanding the possibilities of astrotourism far beyond traditional observation.

73 Adapted from: Darcy, S. and Dickson, T. (2009), 'A whole-of-life approach to tourism: the case for accessible tourism experiences', *Journal of Hospitality and Tourism Management,* volume 16 (1), pp. 32–44, DOI: https://doi.org/10.1375/jhtm.16.1.32.

74 International Organization for Standardization (2021), 'ISO 21902:2021. Tourism and related services – Accessible tourism for all – Requirements and recommendations', ISO, Geneva, available at: https://www.iso.org/standard/72126.html [14-11-2025].

UN Tourism, Fundación ONCE and UNE have published Guidelines based on the ISO 21902:2021 standard that can be found in the UN Tourism Elibrary at: www.e-unwto.org. Additional information on tourism and accessibility is available at:

World Tourism Organization (n.d), 'Accessible Tourism', UN Tourism, Madrid, available at: https://www.untourism.int/accessibility [14-11-2025].

World Tourism Organization (2016), *Manual on Accessible Tourism for All: Principles, Tools and Best Practices – Module I: Accessible Tourism – Definition and Context,* UN Tourism, Madrid, DOI: https://doi.org/10.18111/9789284418077.

75 World Tourism Organization (2013), *Recommendations on Accessible Tourism,* UN Tourism, Madrid, DOI: https://doi.org/10.18111/9789284415984.

7.1 Persons with disability



3D virtual reality glasses for accessible astrotourism.
© Aleksandr Korchagin | Dreamstime.com

As defined in the UN Tourism *Manual on Accessible Tourism for All*, disability arises from the interaction between individuals with functional diversity and environments or attitudes that do not accommodate their access requirements. These barriers are not inherent to individuals, but rather the result of design choices that exclude diversity.[76]

For the purposes of this publication, the term *person with disability* means any person whose full and effective participation in society on an equal basis with others in travel, accommodation and other tourism services is hindered by the barriers in the environment they are in and by attitudinal barriers.[77] Such barriers typically reflect tourism infrastructure, services and information systems that were not conceived with Universal Design principles[78] in mind.

Persons with disabilities include people who have long-term physical, mental, intellectual or sensory impairments. Others who may be included in this group due to difficulties in accessing tourism products and services are people with temporary disabilities, people with crutches during a temporary period, older people, persons carrying luggage, young children or those who are big or small in size and stature.

76 World Tourism Organization (2016), *Manual on Accessible Tourism for All: Principles, Tools and Best Practices – Module I: Accessible Tourism – Definition and Context*, UN Tourism, Madrid, DOI: https://doi.org/10.18111/9789284418077.

World Tourism Organization (2013), *Recommendations on Accessible Tourism,* UN Tourism, Madrid, DOI: https://doi.org/10.18111/9789284415984.

77 The Convention contains no definition of persons with disabilities, as such. Nevertheless, the Preamble and Article 1 state: "Persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others", asper the Final Report of the Ad Hoc Committee on a Comprehensive and Integral International Convention on the Protection and Promotion of the Rights and Dignity of Persons with Disabilities to the UN General Assembly (A/61/611) in 2006.

78 Centre for Excellence in Universal Design (n.d.), 'The 7 Principles', Centre for Excellence in Universal Design, Dublin, available at: https://universaldesign.ie [14-11-2025].

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7.2
Persons with physical disabilities

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Physical disability refers to a reduced capacity for movement or difficulty in performing motor activities. It may affect the upper or lower limbs, or both, and can result from congenital, hereditary, acquired or accidental causes. A distinction can be made between wheelchair users and persons with physical disabilities who are able to walk. An intermediate group includes individuals with walking difficulties who may use mobility aids such as wheelchairs, walking sticks, or crutches depending on the situation.

There are some measures to adapt astrotourism activities and/or infrastructures for people with physical disabilities:

- In case of an unlit activity, inform in advance and consider the use of red lights to provide safe access.
- Make the spaces accessible so visitors with a physical disability can be as independent as possible.

Astrotourism often takes place in remote, dark-sky locations. To ensure full accessibility, physical pathways must be designed to accommodate wheelchair users and people with reduced mobility, including firm and non-slip surfaces, handrails and accessible rest areas. Equipment like telescopes should be height-adjustable and adapted restrooms must be available. In the case of indoor activities (visitor centres, museums, planetariums or similar), consider ramps and lifts for vertical movement.

Accessible path in Joshua Tree National Park, United States of America. © Jason Finn | Dreamstime.com



7.3 Persons with intellectual disabilities

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According to the World Health Organization, intellectual disability (referred to as "disorders of intellectual development" in the ICD-11) is defined as a group of conditions, originating during the developmental period, characterized by significantly below average intellectual functioning (reasoning, learning, problem-solving) and adaptive behaviour (everyday social and practical skills).[79]

Some practical recommendations to ensure full inclusion and making astrotourism activities accessible for individuals with intellectual disabilities include:

- Provide end-users, caregivers, families and educators some information in advance using pictograms, detailing the content of the activity, its duration and materials.
- Make use of storytelling to explain astronomical concepts and phenomena in an engaging way.
- Use 3D models or tactile elements (e.g., textured surfaces representing the planets or the Moon) to enhance understanding.
- Use VR to offer an immersive experience, allowing to simplify complex concepts and to enhance engagement through gamification.
- Take breaks to prevent fatigue and ensure small group sizes for one-on-one support.

7.3.1 Autistic spectrum disorder[80]

"Autism [...] constitutes a diverse group of conditions related to development of the brain." Autism is known as a *spectrum* because of the wide variation in the type and intensity of symptoms people experience. Though autism falls within the category of intellectual disability, the level of intellectual functioning is extremely variable among people with autism and can range from profound impairment to high-functioning.

"Autism is generally characterised by some degree of difficulty with social interaction and communication." This includes difficulties to interpret non-literal and non-verbal language, as well as difficulties to express themselves, to interact and to follow unwritten social rules.

"Other characteristics are atypical patterns of activities and behaviours," such as difficulties to adapt to changes in routine or environment, "difficulty with transitions from one activity to another, a focus on details and unusual reactions to sensations".

79 World Health Organization (WHO) (n.d.), *International Statistical Classification of Diseases and Related Health Problems (ICD-11),* WHO, Geneva, available at: https://icd.who.int/en/ [28-11-2025].

80 Unless otherwise stated, the information and citations in this subchapter are taken from: World Health Organization (2025), 'Autism', WHO, Geneva, available at: https://www.who.int [14-11-2025].

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Based on these traits, some practical tips for successfully ensuring the inclusion of people with autism are:

- Inquire about potential stress or discomfort before stimuli like loud noises or intense lights.
- Provide spatial structure by clearly marking activities with pictograms in designated spaces to minimize stress from constant changes in location.
- Provide temporal structure by utilizing timers to give participants a visual sense of the duration of the activity and grant a predictable experience.
- Use pictograms to present the activity sequence clearly, removing pictograms as each action is completed to indicate progress.
- Use VR to provide experiences tailored to sensory preferences in a predictable and structured environment.
- Conduct activities in small groups with available support for individual attention.
- Use projected telescopes images in case of visual limitations.



Stars around the old Tricias mill, Villa de Garafía, La Palma, Spain. © González, A.

7.4 Persons with sensory disability

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Sensory disabilities encompass a wide range of neurological conditions that affect the ability of the human brain to process sensory information (such as sight, hearing, taste, touch and smell). Because of the diverse nature of sensory disabilities, adaptations of astrotourism activities should be disaggregated by type.

7.4.1 Visual impairment and blindness

Vision impairment occurs when an eye condition affects the visual system and its vision functions. Vision is the most dominant of all senses and plays a critical role in learning, moving, reading and participating.

Many astrotourism activities have a very visual component related to the observation of the night sky and celestial objects and phenomena. However, there are some considerations than can be taken to adapt these activities to people with some degree of visual impairment:

- Offer information through auditory channels, with explanations that are as descriptive and immersive as possible.
- Provide material and information in braille, such as panels or guides.
- Use 3D models or tactile elements that simulate celestial objects, such as planets and stars.
- Use VR to provide a multisensory experience through 3D soundscapes and vibrations that allow users to navigate and experience celestial events through touch and sound.
- Make use of assistive technology, such as mobile apps with audio-based navigation for astrotourism experiences.
- Make the space accessible without any alterations that may hinder their movement or put their integrity at risk.
- In the case of people with limited vision, place them in the front rows and project activities on screens with the highest possible resolution.

7.4.2 Hearing impairment and deafness

A person who is not able to hear as well as someone with standard hearing levels – hearing thresholds of 20 dB or better in both ears – is said to have hearing loss.[81] Hearing loss may be mild, moderate, severe or profound. It can affect one ear or both ears, and leads to difficulty in hearing conversational speech or loud sounds. Deaf people mostly have profound hearing loss, which implies very little or no hearing, and often use sign language for communication.

81 World Health Organization (1991), *Report of the informal working group on prevention of deafness and hearing impairment programme planning*, WHO, Geneva, available at: www.who.int/iris/handle/10665/58839 [23-12-2025].

People with hearing impairments can better participate and enjoy astrotourism activities if the following considerations are given:

- Reduce background noise as much as possible.
- Use a magnetic loop, when feasible available.
- Provide a frequency modulation system.
- Use captions and written guides for all audio-visual content and live presentations.
- Provide trained guides proficient in sign language to enhance engagement and understanding.
- If sign language interpreters are not available during a guided activity, attract the attention of the interlocutor and speak clearly (not shouting) and at a normal pace, vocalising well.
- Place the participants near the activity leader, so that they can follow the explanation through lip-facial reading. Consider extra lighting for this purpose.
- Prioritise visual and hands-on, tactile materials.
- Use VR to offer a multisensory experience: through simulated space environments, users can explore the Universe and understand astronomical phenomena without needing sound-based instructions.

7.4.3 Deafblindness

Deafblindness is a condition in which visual and hearing impairments combine, resulting in major communication and other developmental and learning needs.

To facilitate interaction and effective communication with people with deafblindness during an astrotourism activity, additionally to the above-mentioned considerations, there are these main recommendations that should be followed:

- Use 3D models or tactile elements that simulate celestial objects, such as planets and stars.
- Offer materials, information panels and guides in braille.
- Provide the help of an expert in tactile communication and the use of deafblind fingerspelling.

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08
Sustainability and protection of night skies

Abstract:
This chapter elaborates on the potential contribution of astrotourism to sustainability and environmental conservation. Astrotourism could be considered as an instrument for sustainability, to mitigate climate change and for rural development. Its benefits align with several United Nations Sustainable Development Goals, including SDG 4 (quality education), SDG 5 (gender equality), SDG 8 (decent work and economic growth), SDG 9 (industry, innovation and infrastructure), SDG 10 (reduced inequalities) and SDG 11 (sustainable cities and communities). The success of astrotourism depends on preserving dark skies by minimizing light pollution and promoting energy-efficient lighting, not only enhancing stargazing but also contributing to decarbonization efforts, and benefiting the human health and ecosystems by maintaining natural light-dark cycles. Primarily occurring in rural areas, astrotourism supports socioeconomic development in depopulated areas, turning their dark skies into a valuable resource and preserving cultural heritage, promoting tourism decentralization and expanding overnight stays.

Key words: Sustainability | rural development | United Nations Sustainable Development Goals | dark skies | light pollution | SDG 4 | SDG 5 | SDG 8 | SDG 9 | SDG 10 | SDG 11

Key message:
Astrotourism can be considered an ally of the sustainability goals for multiple reasons: Its fight against light pollution aligns it with decarbonization and energy efficiency, while also benefitting the health of humans ands ecosystem. Astrotourism is also an economic booster in rural areas with dark skies, addressing depopulation and lack of opportunities for the local population.

Blue dark night sky with stars. © Pavlo Vakhrushev | Dreamstime.com

8.1 Sustainability and astrotourism

Astrotourism is oftentimes labelled as an innovative, sustainable form of tourism.[82] In light of the contribution and significant alignment of astrotourism with sustainability issues, whose advantages can be understood through the United Nations Sustainable Development Goals (SDGs). This includes, at least, SDG 4 (quality education), SDG 5 (gender equality), SDG 8 (decent work and economic growth), SDG 9 (industry, innovation and infrastructure), SDG 10 (reduced inequalities) and SDG 11 (sustainable cities and communities).

Table 9.1 **How astrotourism and light pollution relate to the SDGs**

	**Goal 3: Ensure healthy lives and promote well-being for all at all ages** Light pollution is detrimental to our health, while astrotourism activities promote a light-free environment, good health and well-being.
	**Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all** Astrotourism brings ample opportunity for astronomy and light pollution education, both for locals and tourists.
	**Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all** Astrotourism creates jobs and opportunities for rural communities throughout the year.
	**Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation** Astrotourism promotes investment in infrastructure in rural areas and fosters innovation for the sharing of knowledge.
	**Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development** Studies have shown anthropogenic light probably has a detrimental impact on seafloor ecosystems.
	**Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss** Light pollution harms many ecosystems, from disrupting the migration of birds to the hatching of sea turtles, for example.

Source: Dalgleish, H. (2020), 'Astronomy for development', *Astronomy & Geophysics*, volume 61 (6), pp. 6.18–6.21, DOI: https://doi.org/10.1093/astrogeo/ataa084.

82 Escario-Sierra, F.; Álvarez-Alonso, C.; Moseñe-Fierro, J.A. and Sanagustín-Fons, V. (2022), 'Sustainable Tourism, Social and Institutional Innovation – The Paradox Of Dark Sky In Astrotourism', Sustainability, volume 14 (11), p. 6419, DOI: https://doi.org/10.3390/su14116419.

Fayos-Solá, E.; Marín, C. and Jafari, J. (2014), 'Astrotourism: No requiem for meaningful travel', *PASOS Revista de Turismo y Patrimonio Cultural*, volume 12, pp. 663–671, DOI: 10.25145/j.pasos.2014.12.048.

Dalgleish, H.; Mengistie, G., Backes, M.; Cotter, G. and Kasai, E. (2021), 'How can astro-tourism serve the sustainable development goals? The Namibian example', *Instrumentation and Methods for Astrophysics*, DOI: https://doi.org/10.48550/arXiv.2109.04790.

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Astrotourism is often associated with ecotourism and has the potential to contribute to a more sustainable tourism sector. Since it typically takes place in peripheral and rural areas where skies are darkest, it can support the decentralization of tourism, reduce seasonal pressure (as stargazing is possible year-round), and encourage longer stays with night-time activities. However, its actual impact depends on how visitors and operators engage with these destinations – responsible practices are essential to ensure that astrotourism aligns with sustainability goals rather than adding pressure to fragile environments.

Interesting evidence of the alignment of astrotourism and the SDGs is the fact that preserving dark skies has been proposed to be incorporated in the 2030 Agenda: in 2022, "Sky Quality and Access to Starlight" was proposed as SDG18 and a public petition was set, with the support of over 25 countries.[83]

8.1.1 Astrotourism – light pollution and decarbonization

Although the concept of astrotourism goes beyond the night sky observation, including diurnal as well as urban activities, astrotourism reaches its most optimal conditions in destinations with minimal light pollution, such as national parks and remote, rural areas that offer unparalleled views of stars, planets and meteor showers, among other celestial phenomena.

The success of astrotourism depends heavily on maintaining and preserving dark skies, by controlling and minimizing the sources of light pollution and sensitizing the community, which in turn aligns with broader goals of energy efficiency.[84] Reducing light pollution involves using energy-efficient lighting that directs light downward rather than scattering it, with the right intensity and timing, and so benefitting stargazers, human health and the environment. Communities implementing dark sky ordinances regulating outdoor lighting do not only promote astrotourism by enhancing the stargazing experience but also reduce energy consumption, with the concomitant benefit in terms of greenhouse gas emissions, as well as the local public economy. Studies estimate that the energy used to generate light that escapes to space represents at least 1% of global greenhouse gas emissions and causes economic losses of at least USD 50 billion in energy costs annually.[85]

Since energy efficiency is one of the main strategies for decarbonization purposes, astrotourism is closely interconnected with these decarbonization goals and they can mutually benefit from each other. By promoting the preservation of dark skies within the astrotourism industry, it is possible to enhance the experience of stargazers while also contributing to global efforts to reduce carbon emissions.[86] This synergistic approach not only preserves our ability to enjoy the night sky but also helps to protect the planet for future generations.

83 Varela Perez, A.M. (2023), 'The increasing effects of light pollution on professional and amateur astronomy', *Science,* volume 380, pp. 1136–1140, DOI: 10.1126/science.adg0269.

84 Hobkirk, I. (2019), *Recommendations Towards the Development and Optimization of an Astroproduct or Astrodestination – Astrotourism,* Srinakharinwirot University, Bangkok, DOI: 10.13140/RG.2.2.22378.88008.

85 Scorzafava, L. (2022), 'Light is Energy: Estimating the Impact of Light Pollution on Climate Change', DarkSky Updates, published on 2 August 2022, available at: https://darksky.org [05-12-2025].

86 Escario-Sierra, F.; Álvarez-Alonso, C.; Moseñe-Fierro, J.A. and Sanagustín-Fons, V. (2022), 'Sustainable Tourism, Social and Institutional Innovation – The Paradox Of Dark Sky In Astrotourism', Sustainability, volume 14 (11), p. 6419, DOI: https://doi.org/10.3390/su14116419.

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8.1.2 Astrotourism – an ally against depopulation[87]

Astrotourism is intrinsically linked to dark skies that usually occur in rural, depopulated areas. Therefore, the promotion of astrotourism is an opportunity for these destinations to use their low population density as resource and as a means to diversify income-generating activities, thus allowing for a sustainable socioeconomic development. Although there is a lack of comprehensive studies or statistics on the revenue generated by astrotourism, this sector in the island of La Palma, Spain, has a potential value of EUR 29 million per year, according to 2019 figures.[88]

Beyond the economic benefits, astrotourism also valorizes the cultural heritage associated with the sky and therefore helps preserve these cultural values and contributes to the transmission of this traditional knowledge.

8.1.3 Astrotourism – the health of people and ecosystems

Astrotourism is an ally in the fight against light pollution; and the defense of the natural nightscapes not only implies energy efficiency but also has positive impacts on ecosystems. There is extensive literature stating how light pollution (often referred to as "artificial lighting at night" – ALAN) is one of the global change drivers contributing to the worldwide decline of biodiversity.[89]

With the level of concern growing for years, the International Union for the Conservation of Nature has recently launched a report *The world at night*,90 as a means to denounce this pressing challenge. Ecosystems follow the rhythm of natural light–dark cycles which have been stable over geological and hence evolutionary time scales. ALAN induces disruptions of those cycles and affects the structure and functioning of multiple levels and systems of biodiversity that are strongly interconnected,[91] with especially critical effects on nocturnal flora and fauna, particularly migratory species.[92]

Just like other animals, humans are also affected by the exposure to light pollution. There is extensive research showing how ALAN disrupts the human circadian rhythm and lowers melatonin production at night, resulting in sleep deprivation, fatigue, headaches, stress, anxiety and other symptoms.[93] Researchers are exploring the connection between ALAN and other diseases like diabetes and cancer, among others.[94] The contribution of astrotourism to the regulation and sensitization on light pollution is subsequently advocating for human health, as well as ecosystem conservation.[95]

87 Unless otherwise stated, the information and citations in this subchapter are taken from:

University Leiden (2021), 'Astrotourism Workshop – Dark Sky Tourism: An engine for sustainable socio-economic development', YouTube, video live streamed on 28 June 2021, available at: https://www.youtube.com [05-12-2025].

Fayos-Solá, E.; Marín, C. and Jafari, J. (2014), 'Astrotourism: No requiem for meaningful travel', *PASOS Revista de Turismo y Patrimonio Cultural,* volume 12, pp. 663–671, DOI: 10.25145/j.pasos.2014.12.048.

Dalgleish, H.; Mengistie, G., Backes, M.; Cotter, G. and Kasai, E. (2021), 'How can astro-tourism serve the sustainable development goals? The Namibian example', *Instrumentation and Methods for Astrophysics,* DOI: https://doi.org/10.48550/arXiv.2109.04790.

88 Instituto de Astrofísica de Canarias (2025), *Paralajes: La Astrofísica en La Palma*, number 1/2024, IAC, La Laguna, available at: https://iac.es [05-12-2025].

89 Davies, T.W. and Smyth, T. (2018), 'Why artificial light at night should be a focus for global change research in the 21st century', *Global Change Biology,* volume 24, pp. 872–882, DOI: 10.1111/gcb.13927.

90 Welch, D. et al. (2024), *The world at night: Preserving natural darkness for heritage conservation and night sky appreciation,* IUCN WCPA Good Practice Guidelines Series No. 33, International Union for Conservation of Nature, Gland,

91 Hölker, F. et al. (2021), '11 Pressing research questions on how light pollution affects biodiversity', *Frontiers in Ecology and Evolution,* volume 9, DOI: https://doi.org/10.3389/fevo.2021.767177.

92 Longcore, T. and Rich, C. (2016), 'Artificial night lighting and protected lands: ecological effects and management approaches', *Natural Resource Report NRR-2017/1493,* DOI: 10.13140/RG.2.1.2032.4088/1.

93 Chepesiuk, R. (2009), 'Missing the dark: health effects of light pollution', *Environmental Health Perspectives,* volume 117 (1): A20–A27, DOI: 10.1289/ehp.117-a20.

94 Davies, T.W. and Smyth, T. (2018), 'Why artificial light at night should be a focus for global change research in the 21st century', *Global Change Biology,* volume 24, pp. 872–882, DOI: 10.1111/gcb.13927.

95 Dalgleish, H. (2020), 'Astronomy for development', *Astronomy & Geophysics,* volume 61 (6), pp. 6.18–6.21, DOI: https://doi.org/10.1093/astrogeo/ataa084.

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Bedouin tent camp in Wadi Rum, Jordan.
© Kristofbellens | Dreamstime.com

8.1.4 Sustainability in the astrotourism industry

Beyond the alignment of the astrotourism industry with SDGs, astrotourism, as all types of tourism, needs to follow the ecotourism principles in order to ensure maximum benefits aligned with a minimum environmental footprint:[96]

- Low-impact astrotourism activities: Astrotourism activities should be designed to have a minimal environmental footprint. This includes controlling the access to certain natural areas, preventing overcrowding and regulating their carrying capacity, considering the use of collective transportation, avoiding the use of plastics, managing waste and promoting low-impact facilities and infrastructures as much as possible.

- Ecosystem conservation: Astrotourism must be linked to measures that minimize light pollution.

- Local community involvement: Engaging local communities in astrotourism initiatives can provide economic benefits and promote the valorization of the local cultural heritage. Locals should actively participate in the development of tourism products and by serving as guides, providing accommodation and sharing knowledge about their night sky traditions and beliefs.

- Gender equality: Like all types of tourism, astrotourism should embrace an inclusive approach, ensuring equitable participation and opportunities for all, regardless of gender.

- Education and outreach: Astrotourism could be linked to education tourism.[97] It can serve as an educational tool, raising awareness about light pollution, environmental protection and the value of cultural heritage.

96 The International Ecotourism Society (n.d.), 'What is ecotourism?', available at: https://ecotourism.org/ [17-07-2024].

97 World Tourism Organization (2019), *UNWTO Tourism Definitions*, UN Tourism, Madrid, DOI: https://doi.org/10.18111/9789284420858.

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8.2 Protection of night skies

Light pollution, understood as the **inappropriate or excessive use of artificial light at night,**[98] is erasing the stars from our skies, causing the deterioration of a legacy with profound cultural, scientific, environmental and aesthetic repercussions, some of which have already been discussed.

Light pollution has become a global phenomenon affecting most towns and cities. Inefficient lighting leads to unjustified excess of energy and economic consumption and increases the level of greenhouse gases that contribute to climate change. Oftentimes, this excess of artificial lighting is associated with spectral light pollution, which is caused by the use of lamps that emit light in ranges of the spectrum that are useless for illuminating our streets and for our safety, and harmful to the environment, biodiversity and human health.[99]

With 85% of the global population living under polluted skies,[100] it is becoming increasingly difficult to observe the night sky in its pristine magnificence; remote sites chosen to host the most sophisticated astronomical observatories because of their appropriate dark location, are gradually being threatened by light pollution and radio signal interference. Among other threats to the quality of the night sky for astronomical observation, space debris is becoming a global problem because of its threat especially to the communications and security of Earth observation and climate change study satellites. More recently, a new and additional negative impact on night sky observation, the mega constellations of low Earth orbiting satellites (LEOs), has emerged.

The efforts of the Instituto de Astrofísica de Canarias (IAC, Institute of Astrophysics of the Canary Islands) in Spain against light pollution in the night sky has been a constant, logical worry to the point that a national law was promoted, the Sky Law (Act 31/1988),[101] a pioneering law in the protection of the sky in the islands of La Palma and Tenerife. It became the precedent for similar regulations in other areas of the planet. In addition, the IAC Technical Office for Sky Protection (OTPC, Oficina Técnica de Protección de la Calidad del Cielo) was created, specializing in monitoring and advice in the field.

8.2.1 La Palma Declaration (2007)

The perception of the sky as a resource to be safeguarded not only for science, but also as a cultural, environmental and biodiversity heritage, for health and quality of life and as an engine of sustainable economy through astrotourism, emanates from the Starlight Initiative that was born with the Declaration in Defense of the Night Sky and the Right to Starlight at the First

98 DarkSky International (n.d.), 'What is light pollution?', DarkSky, Tucson, available at: https://darksky.org [02-12-2025].

99 Hölker, F. et al. (2010), 'The dark side of light: a transdisciplinary research agenda for light pollution policy', *Ecology and Society,* volume 15 (4), p. 13, available at: https://www.jstor.org/stable/26268230 [02-12-2025].

Falchi, F.; Cinzano, P.; Elvidge, C.D.; Keith, D.M. and Haim, A. (2011), 'Limiting the impact of light pollution on human health, environment and stellar visibility', *Journal of Environmental Management,* volume 92 (10), pp. 2714–2722, DOI: https://doi.org/10.1016/j.jenvman.2011.06.029.

100 Falchi, F. et al. (2016), 'The new world atlas of artificial night sky brightness', *Science Advances,* volume 2 (6), DOI: 10.1126/sciadv.1600377.

101 Jefatura del Estado (1988), 'Ley 31/1988, sobre Protección de la Calidad Astronómica de los Observatorios del Instituto de Astrofísica de Canarias', *Boletín Oficial del Estado,* BOE-A-1988-25332, ELI: https://www.boe.es/eli/es/l/1988/10/31/31/con.

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International Starlight Conference held in April 2007 on the island of La Palma, Spain.[102]

There, representatives of the IAC, UN Tourism, the International Astronomical Union (IAU), the United Nations Environment Programme (UNEP-CMS), the Council of Europe (COE), the Secretariat of the Convention on Biological Diversity (SCBD), the Man and the Biosphere (MaB) Program, the European Union (EU) and Ramsar-Convention, and numerous other organizations and institutions from more than 23 countries, launched this international movement in defense of the night sky, promoting the dissemination of astronomy and sustainable and quality tourism in those places where the night sky is cared for.

Interestingly, the XXVII IAU General Assembly, held in August 2009 in Rio de Janeiro, Brazil, unanimously approved Resolution B5 in Defense of the Night Sky[103] and the Right to Starlight, recognizing the principles expressed in the Starlight Declaration. Since then, the IAU has significantly increased its work in this line, especially through Division C (Education, Outreach and Heritage), or with the creation of commissions and working groups such as Commission C4 (World Heritage and Astronomy), the Dark and Silent Sky Protection Working Group, the Astronomical Heritage in Danger Working Group and the Achieving Sustainable Development in a Quality Illumination Framework Working Group.

8.2.2 The Starlight Foundation and the Starlight certification system

The Starlight Foundation, a non-profit legal entity created in 2009 by the IAC and the consulting firm Corporación 5, was founded as the body responsible for the Starlight Initiative, providing human resources and means for its development and promotion.

The Starlight Foundation promotes local, national and international initiatives that enable the protection of this common heritage that is the starry sky and its scientific and cultural use, including the implementation of intelligent lighting systems that avoid light pollution, enable energy savings and mitigate the effects of climate change.

To this end, the Starlight Foundation has created an international certification system that accredits those areas that have excellent sky quality and represent an example of protection and conservation. Likewise, this certification aims to foster economic development in eminently rural territories, contributing to mitigate depopulation and developing astrotourism.

The Starlight Reserve concept was established at the UNESCO World Heritage Center, Paris, in October 2007. The final document was adopted during the International Workshop and Expert Meeting on Starlight Reserves and World Heritage held in Fuerteventura in 2009. It is a protected natural area in which a commitment is made to protect the quality of the night sky and to facilitate access to starlight in order to preserve the quality of the night sky and the different associated values, whether cultural, scientific, astronomical or natural landscape. The Starlight Reserve concept is accompanied in each case by a Participatory Action Plan and a set of recommendations.[104]

102 Consult for details: Starlight Initiative; La Palma Biosphere Reserve; Instituto de Astrofísica de Canarias; Government of the Canary Islands; Spanish Ministry of the Environment; UNESCO MaB (2007), *Declaration in Defence of the Night Sky and the Right to Starlight (La Palma Declaration)*, International Conference on the Quality of the Night Sky and the Right to Observe the Stars, La Palma, Canary Islands, Spain, 19–20 April 2007, Starlight Foundation, San Cristóbal de la Laguna, available at: https://en.fundacionstarlight.org [26-11-2025].

Marín, C. (2009), 'Starlight: a common heritage', *Proceedings of the International Astronomical Union. 2009*, volume 5 (S260), pp. 449–456, Cambridge University Press, DOI: https://doi.org/10.1017/S1743921311002663.

103 Starlight Initiative (2009), *IAU Resolution B5: In Defence of the Night Sky and the Right to Starlight*, available at: www.starlight2007.net/iauresolutionb5.html

104 Marín, C. (2009), 'Starlight: a common heritage', *Proceedings of the International Astronomical Union. 2009*, volume 5 (S260), pp. 449–456, Cambridge University Press, DOI: https://doi.org/10.1017/S1743921311002663.

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Starlight Tourist Destinations are places with ideal conditions for stargazing and where light pollution is controlled. This makes them logical destinations for tourism based on the appreciation of the sky as part of the natural world. Not only must they demonstrate the quality of their sky and the means to ensure its protection, but they must also have adequate tourism infrastructures and their integration into night-time nature. The criteria were established in December 2010 with representatives from UNESCO, Man and the Biosphere Programme (MAB) and IAC.

In 2024, there were 22 Starlight Reserves, 71 Starlight Tourist Destinations, a network of more than 91 certified rural hotels and other lodges, 15 Stellar Parks, 17 companies and 22 other modalities, 1,226 Starlight Declaration Adhesions and a certificated surface of 142,469 km^2 in more than 15 countries.



Night sky in Caldera de Taburiente Natural Park, La Palma, Spain. © Wirestock | Dreamstime.com



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09
Case studies

Abstract:

This chapter explores a series of case studies on world-leading astrotourism destinations, showcasing how various locations around the globe are leveraging their unique natural conditions and distinctive resources to attract tourists and consolidate as astrotourism destinations. The chapter examines renowned sites in Spain, New Zealand and Chile, highlighting their strategic initiatives, infrastructure and efforts to balance tourism with the preservation of dark skies. It also considers examples from the Best Tourism Villages by UN Tourism (BTVs) initiative that best reflects the connection between astrotourism and rural areas, where small communities use their skies to foster local development. Together, these cases offer valuable insights into practices, lessons learned and the potential of astrotourism as a tool for rural development, as well as environmental conservation and public education in astronomy.

Astronomical observatory, Teide Mountain, Spain. © Mariusz Burcz | Dreamstime.com

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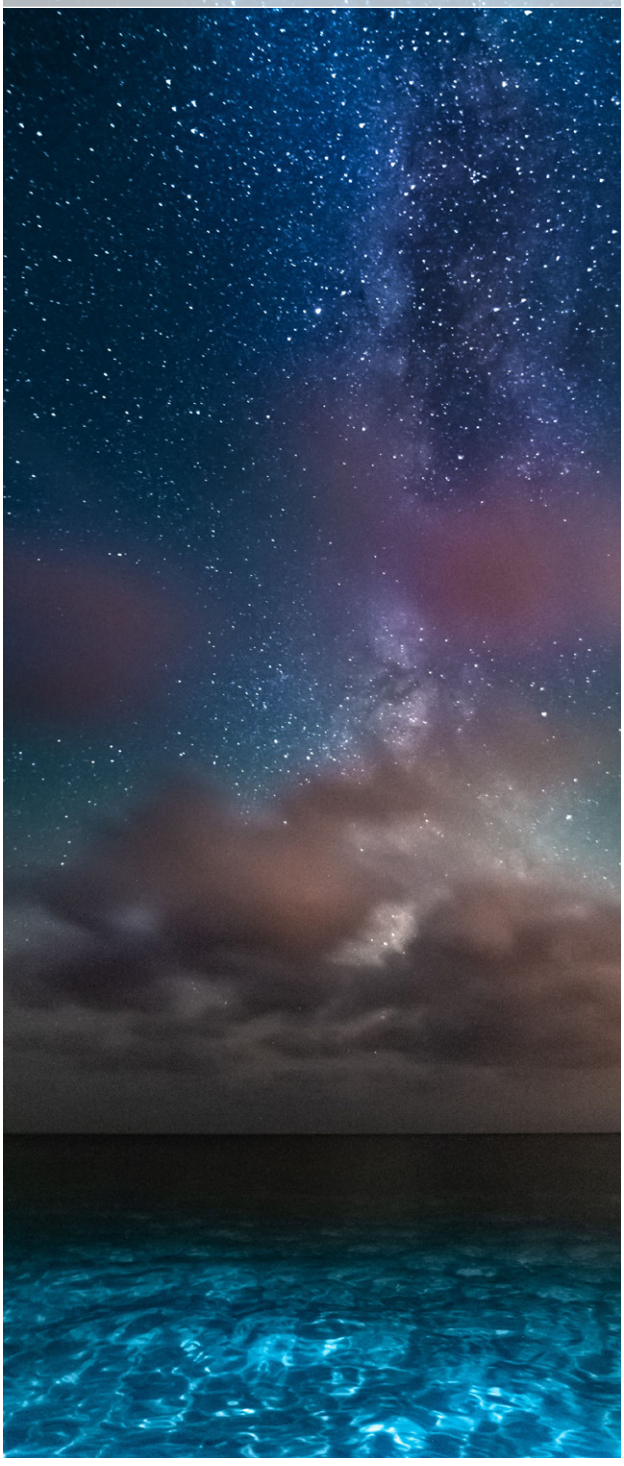
9.1 Astrotourism in Spain – Two prominent islands

La Palma and Tenerife in Canary Islands, Spain, stand among the leading astrotourism destinations in the world thanks to their exceptional night skies, protected since 1988 by the pioneering Sky Law.[105] Both islands combine scientific excellence with tourism innovation, offering visitors unique experiences that blend astronomy, culture and nature.

La Palma hosts the renowned Roque de los Muchachos Observatory (ORM), home to the *Gran Telescopio Canarias* and other cutting-edge instruments, turning its summits into an open-air scientific museum. The island also features a network of 14 astronomical viewpoints, themed trails and events such as the AstroFest and the Blackout – Turn off the light and turn on the stars. Public-private cooperation has fostered a strong entrepreneurial network, branded Stars Island La Palma, while accommodations, gastronomy and cultural offerings integrate astronomy into every aspect of the visitor experience.

Tenerife combines over 300 clear nights annually with world-class facilities like the Teide Observatory and a UNESCO-listed natural and cultural heritage. Certified as both a Starlight Reserve and Tourist Destination, the island offers astro-volcanic routes, specialized guides, and thematic experiences linking wine, culture and astronomy. With more than 300,000 astrotourists in 2024, Tenerife has become a global benchmark, demonstrating how science, heritage and tourism can converge sustainably.

Starry night sky over tranquil ocean.
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105 Jefatura del Estado (1988), 'Ley 31/1988, sobre Protección de la Calidad Astronómica de los Observatorios del Instituto de Astrofísica de Canarias', *Boletín Oficial del Estado*, BOE-A-1988-25332, ELI: https://www.boe.es/eli/es/l/1988/10/31/31/con.

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9.1.1 La Palma Starlight Reserve and Starlight Tourist Destination, Spain

The island of La Palma, the north-westernmost island of the Canary Islands archipelago, is internationally recognized as a reference in astrophysics due to the presence of the Roque de los Muchachos Observatory (ORM) – one of the most advanced in the world and located 2,426 metres above sea level. The island combines clear skies free of light pollution with a stable, turbulence-free atmosphere, offering optimal conditions for astronomical observation. These conditions have been protected since 1988 through the pioneering Sky Law, which regulates conditions to preserve sky quality for astronomical research supporting the development of astrotourism. These unique geographic and environmental characteristics in combination with the accreditation as a Starlight Reserve and Tourist Destination by the Starlight Foundation reinforce the position of La Palma as a privileged place for observing the night sky. Additionally, the island offers rich landscapes and cultural diversity, having been declared a Biosphere Reserve by UNESCO. Its central area, the Caldera de Taburiente National Park, enjoys the highest level of natural protection.

La Palma has established itself as a destination for astronomy enthusiasts, in part thanks to extensive co-governance and public-private cooperation around the Working Group on Astrotourism *(Mesa de Astroturismo)*. Product innovation and new initiatives have emerged around the Astrotourism Entrepreneurs Group, active since 2013. This network brings together more than 70 organizations and professionals under the common seal of Stars Island La Palma.

As a whole, the astrotourism offer combines science, education and leisure to attract a diverse range of tourists with a wide variety of experiences. Below is a list of the most distinctive resources, products and experiences of the island:

1. **Visit to the telescopes of the Roque de los Muchachos Observatory (ORM):**

   - The scientific complex at ORM houses state-of-the-art telescopes, such as the Gran Telescopio Canarias (GTC), whose segmented mirror of 10.4 m in diametre is the largest optical and infrared telescope in the world;
   - The recently installed large-sized telescopes (LSTs), with 23-metre-diametre mirrors and lightweight structures for quick orientation; and
   - The MAGIC telescopes: two 17-metre telescopes specialized in detecting very high-energy rays and visually striking in design.

   Their exceptional location on the mountain summits at the heart of the national park, transforms the area into an open-air scientific museum. Guided tours of various telescopes –particularly the GTC– offer a fascinating educational experience, exploring facilities typically reserved for scientists. Specially trained Starlight guides explain the operation of the telescopes, the importance of the research conducted and the unique atmospheric conditions of La Palma for observing the sky.

2. **The Roque de los Muchachos Visitor Center**

   Open since 2021, the Roque de los Muchachos Visitor Center is located near the ORM. It is a tourist center dedicated to astronomy outreach, offering immersive, educational and leisure experiences through self-guided or guided tours designed for all audiences.

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The great hall features an auditorium, a panel of interactive touch tables exploring the telescopes outside, and a gift shop. It includes three thematic rooms:

1. Canary Islands, A Window to the Universe, focussing on observation conditions of La Palma;
2. Exploring the Universe, which immerses visitors in cosmic mysteries and scientific advances; and
3. Back to Earth, highlighting the traditions, lifestyle and heritage of the surrounding municipality.

Educational talks enhance the scientific experience.

3. Astronomical viewpoints and trails: night-time observation activities.

La Palma offers a network of micro-infrastructures and equipment for celestial observation. The 14 astronomical viewpoints, located in areas with minimal light pollution and the astronomical trails are particularly notable.

Each viewpoint is equipped with informational panels and signage, featuring themes inspired by the science and culture of the sky. These explain celestial phenomena, constellations, and astronomical cycles such as equinoxes and solstices. Designed for both daytime panoramas and night-time stargazing, the viewpoints are commonly used by guides and astrotourism companies. Supported by portable telescopes, binoculars and other tools, these professionals offer guided observations, thematic routes and workshops combining astronomy, entertainment and environmental education. Some of the active companies are Astro La Palma, AdAstra La Palma, Athos Star Campus, Astro Norte, Canary Live Experience, Isla Bonita Tours, Canarias Photo Tours, SkyPalma, and Start La Palma.

Notable sites include the Llano del Jable viewpoint in El Paso for viewing the Milky Way and the Monumento al Infinito viewpoint, located above 2,000 metres and near ORM, featuring an interactive display on seasons and constellations.

La Palma also has four astronomical trails integrated within its larger trail network. These routes connect with viewpoints and merge hiking with sky exploration: The “Full Moon Route” follows the famous “Volcanoes Route” at night, while “Observatories and Stars” traverses part of the mountain range of the national park near iconic ORM telescopes and notable geological and archaeological sites.

4. Astronomical events: AstroFest La Palma and Blackout – Turn off the light and turn on the stars

Astrotourism in La Palma features diverse, themed events. Since 2015, the AstroFest La Palma has brought together scientists, artists and enthusiasts in a multidisciplinary celebration of the night sky.



Cherenkov telescopes from the Roque de los Muchachos Observatory, La Palma, Spain. In the background, Comet Neowise, the airglow and the Milky Way. © González, Antonio

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Spanning several months, its programme includes astrophotography workshops, lectures, stargazing, concerts, cultural shows, business meetings, astrocamps, contests, film screenings and more – promoting awareness, education and entertainment while boosting astrotourism.

Highlights include:

- The Full Moon Trail night race, combining sport and stargazing;
- The Festivalito de Cine de las Estrellas, a short film festival that merges film-making, nature and the night sky, awarding the Polar Star Award; and
- Astromaster La Palma, a week-long advanced astrophotography training combining hands-on practice under dark skies with technical workshops.

A standout event is Blackout – Turn off the light and turn on the stars, which raises awareness of light pollution and invites people to rediscover the night sky. During blackouts, municipalities switch off public lights, creating ideal stargazing conditions enhanced with music, films and themed tours.

5. Themed accommodations

As part of the Stars Island La Palma network, themed accommodations provide immersive astrotourism experiences. Hotels, rural houses and apartments designed with landscape integration and a boutique concept offer informational signage, telescopes or binoculars, star charts and outdoor observation spaces like rooftops and cisterns. Some offer guided stargazing sessions and highlight Indigenous cultural views of the cosmos, such as those of the Awara people.

These establishments prioritize comfort, sustainability and sky protection. Notable examples include Casa Rural El Pósito, certified by the Starlight Foundation; Casa Rural Carlota, with a dedicated viewpoint and educational panels; and Casa Rural Villa Asunción, featuring astronomy-themed decor and outdoor viewing spaces.

6. Stellar G-astronomy

Gastronomy in La Palma integrates cosmic themes into its culinary offerings, with dishes inspired by constellations, planets and astronomical imagery. Themed menus combine flavour, colour, texture and temperature with storytelling linked to the cosmos. Local wines bearing star- and planet-themed names enhance the experience:

- Bodega Teneguía, the first Starlight-certified winery, offers tastings under the stars with stories connecting wine, volcanoes and Venus.
- The Salt Garden Restaurant merges salt landscapes, the night sky and local cuisine through g-astronomical experiences that combine sea salt tastings with night-time observation.
- Likewise, the Vega Norte winery offers a thematic experience: the very name references the star Vega, its label is inspired by the stars and the store is decorated with astronomical elements.

All of this theming has allowed the island to transform its skies into a cultural, educational, and tourist resource of great value. From the first impression upon landing to the last visit to the souvenir shop, visitors are continually reminded of the firmament they have enjoyed in multiple ways while in La Palma.



Petroglyphs in La Palma, Spain. © Navarro, Enrique

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Sky Law: A legal framework for sky protection

Preservation of the exceptional sky quality of La Palma is safeguarded by Law 31/1988 for the Protection of the Astronomical Quality of the Observatories of the IAC – known as the Sky Law[a] – and its subsequent regulatory development (Royal Decree 389/1992). This was the first law in the world specifically created to protect astronomical observation from various forms of pollution and interference.

The law addresses four types of pollution that may affect observational astronomy:

1. Light pollution: It establishes strict criteria for outdoor lighting systems, including orientation, intensity and permitted spectral ranges. Many municipalities reduce light levels by at least 50% after midnight. These measures have resulted in reductions of up to 28% in sky brightness).b
2. Atmospheric pollution: Industrial emissions are restricted, especially above 1,500 metres in elevation, to preserve clean atmospheric conditions required for high-altitude observatories.
3. Radioelectric pollution: Emissions in sensitive frequency bands are limited to prevent interference with radio telescopes.
4. Air traffic interference: Regulations discourage overflights in proximity to the observatory area, avoiding contrails and atmospheric turbulence.

The Sky Law applies to La Palma and parts of Tenerife and is implemented by the Technical Office for the Protection of the Sky (OTPC) of the Canary Islands Institute of Astrophysics (Instituto de Astofísica de Canarias – IAC), established in 1992. Its mission includes monitoring compliance, coordinating with local authorities and supporting dark-sky policies. Over the years, the implementation of this legal framework has led to significant energy savings, the development of night-sky-friendly infrastructure and the consolidation of international prestige of La Palma as an astronomical destination.[b]

a) Jefatura del Estado (1988), 'Ley 31/1988, sobre Protección de la Calidad Astronómica de los Observatorios del Instituto de Astrofísica de Canarias', *Boletín Oficial del Estado*, BOE-A-1988-25332, ELI: https://www.boe.es/eli/es/l/1988/10/31/31/con.

Consult for more information about the Sky Law chapter 8.2.

b) Instituto de Astrofísica de Canarias (n.d.), '*Protección del Cielo*', IAC, La Laguna, available at: www.iac.es/es/observatorios-de-canarias/sky-protection [18-12-2025].

Starlight Foundation (2023), 'La Palma, Destino Turístico Starlight', Starlight Starlight Foundation, San Cristóbal de la Laguna, available at: https://fundacionstarlight.org [25-11-2025].

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9.1.2
Tenerife – a star destination

Tenerife has gained prominence among the most important destinations in the world for astrotourism thanks to the extraordinary quality of its night sky. The island has turned its sky into a strategic resource, supported by a solid scientific base and a growing network of specialized operators. In addition, its exceptional climatic and geographic conditions allow for more than 300 clear nights a year in the highlands.

Tenerife has an exceptional set of international recognitions that highlight its natural and scientific wealth. The Teide National Park was declared a World Heritage Site by UNESCO in 2007 for its unique geological and ecological characteristics. In addition, the island is part of the UNESCO World Network of Biosphere Reserves, which reinforces its commitment to sustainable development and environmental conservation.

The island has exceptional astronomical conditions regulated by the Sky Law since 1988[106] which protects its observatories and celestial landscapes from light, atmospheric, radioelectric and air traffic interference.

Recognized by the Starlight Foundation, Tenerife was one of the first places in the world to obtain certification as a Starlight Reserve for the Cumbres de Tenerife and Starlight Tourist Destination for Las Cañadas del Teide National Park, which guarantees that visitors can enjoy authentic experiences under a quality starry sky. This certification adds to a long history of links with astronomy, with milestones such as the founding of IAC and the presence of the prestigious Teide Observatory, one of the most important in the northern hemisphere.

More than 300,000 people (4.9% of tourists who visited the island of Tenerife) have participated in an astrotourism activity during 2024. In Tenerife, astrotourism is emerging as a product with great potential to diversify the offer, break the seasonality and generate added value to the destination from an innovative perspective.

For those who wish to plan their astronomical visit, the official Tourism portal of Tenerife offers a section dedicated to astrotourism, with useful tips, recommended preparations and recommendations for safety and sustainability.[107]

1. Tenerife: pioneer in high altitude astronomical observation

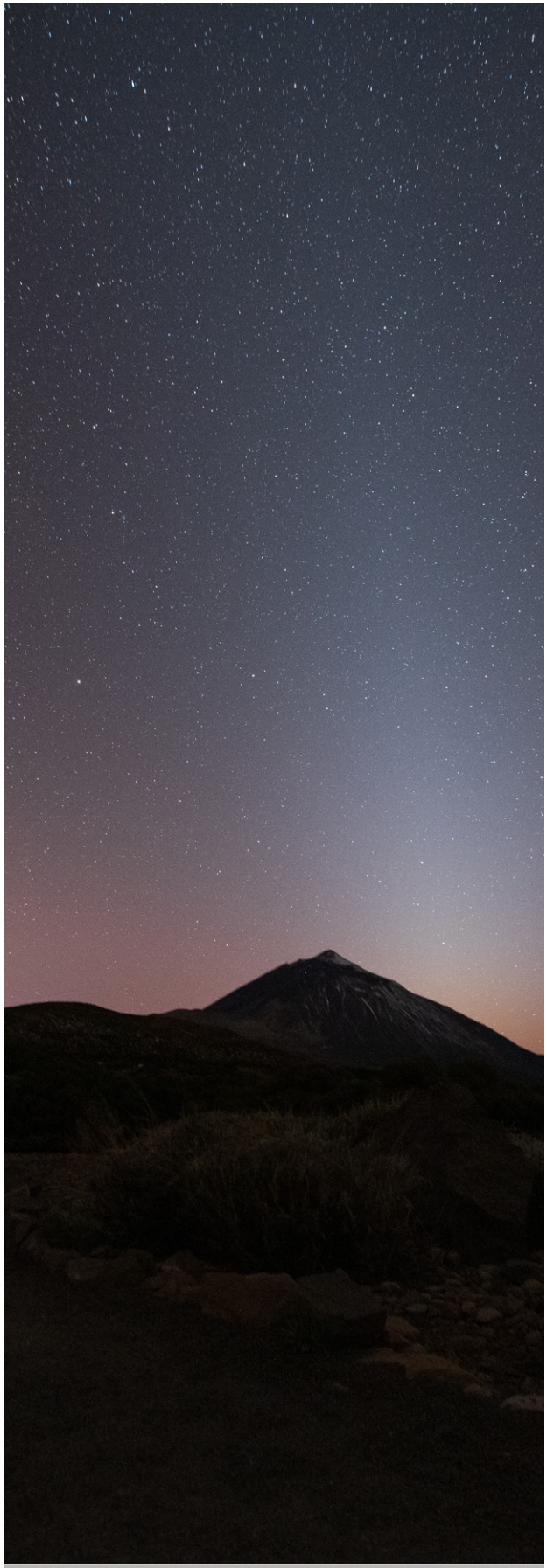
Tenerife is not only a global leader in astrotourism but also holds a prominent place in the history of astronomy. In 1856, the Scottish astronomer Charles Piazzi Smyth, then Astronomer Royal for Scotland, led a scientific expedition to Pico del Teide with a revolutionary objective for his time: to demonstrate that astronomical observations are more precise and stable at high altitudes.

During his stay on the summits of Tenerife, Piazzi Smyth set up observational instruments and conducted pioneering measurements of atmospheric transparency, temperature and sky stability. His findings marked a turning point in modern astronomy and laid the groundwork for the future installation of high-altitude observatories around the world.

106 Jefatura del Estado (1988), 'Ley 31/1988, sobre Protección de la Calidad Astronómica de los Observatorios del Instituto de Astrofísica de Canarias', *Boletín Oficial del Estado*, BOE-A-1988-25332, ELI: https://www.boe.es/eli/es/l/1988/10/31/31/con.

107 For more information consult: Turismo de Tenerife (n.d.): https://www.webtenerife.com/que-hacer/naturaleza/observacion-estrellas/ [15-11-2025].

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Zodiacal light and Mount Teide in Tenerife, Spain.
© Enrique, Orisbel

Thanks to that visionary expedition, Tenerife is considered the site of the first high-mountain astronomical observatory in the world, earning it recognition as the cradle of high-altitude astronomy.

In recognition of this historic contribution, the Moon today bears two named features evoking this legacy: Montes Tenerife and Mons Pico. Both are located in the Mare Imbrium and were named in honour of the island of Tenerife and Pico del Teide, thereby extending the legacy of Piazzi Smyth beyond the Earth into lunar cartography.

This astronomical heritage has inspired the creation of an Astrovolcanic Route on the Teide, composed of a network of viewpoints that integrate geological and astronomical interpretation of the landscape.

2. The sky as cultural heritage

Astrotourism in Tenerife is rooted not only in scientific observation but also in the cultural interpretation of the sky. Traditional stories, constellation myths and historical narratives related to navigation and agriculture are often woven into the interpretive framework of many experiences. This fusion of science and culture strengthens local identity and promotes tourism that respects and values intangible heritage.

This multifaceted approach has positioned Tenerife as a leading destination for astrotourism, appealing to those seeking scientific discovery, recreational stargazing or a deeper connection with nature. As a result of this commitment, the island has developed a comprehensive network of infrastructure and astronomical sites that combine cutting-edge scientific facilities with exceptional natural environments for observing the night sky.

3. Infrastructure and astronomical sites

Tenerife offers a unique combination of scientific infrastructures and natural viewpoints to enjoy the starry sky:

- The Teide Observatory: Located at an altitude of 2,390 metres in Izaña, this bservatory is one

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of the most outstanding scientific enclaves in Europe and the place where astrophysics began in the Canary Islands. Since the installation of the first telescope in 1964, it has hosted pioneering research such as the study of zodiacal light and the birth of helioseismology in 1979, a technique that allows the study of the interior of the Sun through its vibrations.

Thanks to its geographical conditions and the quality of the sky, the observatory has specialized in solar observation, housing reference telescopes such as GREGOR, the largest solar telescope in Europe. It also has night telescopes, robotic telescopes and experiments dedicated to cosmic background radiation. Important discoveries have been made from this site, such as the observations of planets outside the solar system. In the future, it could be key to the detection of traces generated by the Big Bang.

The observatory offers school and group visits organized by the IAC, which include educational talks in an old dome converted into an outreach center. They explain how an observatory works, how the telescopes operate and why astronomy is fundamental to human knowledge.

- Museum of Science and the Cosmos: located in San Cristóbal de La Laguna, this museum is a reference in scientific dissemination in the Canary Islands and a fundamental pillar for the popularization of astronomy. Through interactive exhibits, workshops, lectures and solar and night-time observations, the museum brings astronomy and other scientific disciplines to all audiences. Its planetarium and its playful approach make it ideal for individual visitors, as well as for families and school groups.

- Astronomical viewpoints in the national park: thanks to the Astrovolcanic Route project, several astronomical viewpoints on Teide combine geological interpretation with astronomical information.

4. Specialized companies and professional guides

Tenerife has a consolidated network of companies offering astronomical observation activities, guided tours and experiences under the stars. In addition, the island has a solid group of guides specialized in astrotourism, many of which trained and accredited as Starlight Monitors and Astronomical Guides. Many nature activity companies also offer stargazing with high quality standards.

The experiences in astrotourism that stand out are:

- Teide By Night and Starsexcursions, which offer astronomical observation from the Teide with criteria of sustainability and interpretative quality;

- El Lomo winery, in the north of the island, which integrates wine tourism activities with sky observation, reinforcing the link between territory, local product and astronomy; or

- The company AsterArk, which carries out day and night observations and other activities adapted to customers, demonstrating its commitment to excellence in astrotourism services.

5. Charming accommodations and sky

Some accommodations in Tenerife have specialized in offering services adapted to astrotourism, such as:

- Personalized astronomical information;

- Telescopes at guests' disposal;

- Guided night activities; or

- Zones without light pollution in their surroundings.

Among the accommodations, the Parador de Las Cañadas del Teide located at an altitude of over 2,000 metres in the national park, in a privileged enclave for astronomical observation, stands out. Thanks to its location in an area with low light pollution and clear skies most of the year, it has

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established itself as a reference lodging for night sky lovers. The Parador complements its offer with astronomical information, observation activities and a specially oriented attention to those seeking to live a unique experience under the stars, thus becoming an example of integration between hospitality, sustainability and scientific dissemination.

This growing offer responds to an increasing interest of visitors to live complete experiences of connection with nature and the sky.

6. Other sites on the island for astrotourism

At the local level, the municipality of La Matanza de Acentejo has been accredited as a Starlight Municipality, being one of the first in the archipelago to receive this certification. The distinction values the work developed by the municipality in the protection of the sky, the regulation of public lighting and the promotion of cultural and tourist activities related to astronomy.

In addition, Tenerife is home to the Camino Barranco de Badajoz Starlight Park in Güímar, one of the few if its kind in the world. This unique enclave stands out for its natural, historical and scenic value, and for its astronomical interpretation activities aimed at environmental education and awareness.

7. Training and commitment to the dark sky

Tenerife has made a firm commitment to training as the basis for the development of astrotourism and the protection of the night sky. Training initiatives have been promoted for local guides, tourist companies, rural lodging and social groups, addressing topics such as:

- Sky interpretation techniques;
- Protection of the night sky against light pollution, through courses and workshops organized in collaboration with the Starlight Foundation and the Technical Office of Sky Protection of the IAC, aimed at lighting and tourism technicians of the municipalities of Tenerife; and
- Good practices in sustainability and responsible astrotourism.

These actions reinforce the commitment of Tenerife to a sustainable astrotourism model, professionalized and aligned with the protection of the sky as a natural, scientific and cultural heritage.

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Full moon over the Teide Observatory, Tenerife, Spain. © Enrique, Orisbel

9.2 Astrotourism in Chile

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Chile has become a leading destination for astrotourism, thanks to the exceptional quality of its skies and the high concentration of scientific astronomical observatories that have been established for over 60 years.

Since 2015, there has been a Roadmap for Astrotourism in Chile, aimed at improving the quality, appeal, diversity, sustainability and planning of its astrotourism offerings in the short, medium and long term, with the goal of providing a memorable experience for tourists engaged in this activity.

Though Chile counts with naturally favourable conditions for quality dark skies due to its geography, the country has paid due attention to the preservation of the most important resource for astrotourism. In addition to educational campaigns, one of the most significant milestones for the preservation of dark skies and the whole astrotourism industry is the implementation of policies and measures to reduce light pollution. In 2022, the Ministry of the Environment established a Standard for Artificial Light Emissions from Outdoor Lighting, developed from a review of Supreme Decree No. 43 of 2012, introducing regulations on public and private lighting and promoting the use of lights that minimize skyward dispersion. This new regulation extends its reach nationwide and introduces much stricter technical requirements, reinforcing Chile's commitment to protecting its night skies[108].

Initiatives have been undertaken to promote and market astrotourism offerings in Chile. Events like the Total Solar Eclipse in 2019, which attracted over 300,000 visitors, or the International Astrotourism Summit in 2023, have significantly helped consolidate Chile as one of the astrotourism leaders in the world.

From the public sphere, the Chilean Government has invested resources in the installation of astrotourism observatories in partnership with local governments in areas suitable for the development of the activity. It has also supported the technical training of human resources, such as astrotourism guides who also work in private astrotourism companies.

Within Chile, the prime destination for astrotourism is the northern Coquimbo region. With over 300 clear days a year and a light-pollution-free sky, this region hosts some of the best conditions for astronomy, and is home to a vast collection of astronomical infrastructures, both for professional and tourism purposes. After years of astrotourism promotion and development, the region was rebranded as the Región Estrella (Star Region). This marketing strategy helped it consolidate as a world-class astrotourism destination and has fostered the professionalization and growth of the entire sector, which nowadays counts with more than 50 tour operators. From professional observatories, to horse-riding under the sky, to pisco-tasting or wellness tours – in Coquimbo, virtually every attraction is paired with the night sky.

All these efforts and strategies have helped Chile advance its position as a premier destination for astrotourism worldwide, allowing both tourists and future generations to enjoy its night sky.

108 Ministerio del Medio Ambiente (2022), 'Decreto Supremo N.º 1, que establece norma de emisión de luminosidad artificial generada por alumbrados de exteriores', Diario Oficial de la República de Chile, disponible en: https://luminica.mma.gob.cl/ [15-01-2026].



From the inside of the observatory in Vicuña, Chile © Jesse Kraft | Dreamstime.com

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9.3 Astrotourism in India[109]

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Astrotourism in India presents itself as an innovative opportunity to foster socioeconomic development in rural areas, promoting nature-based livelihoods and generating new sources of income for local communities. This approach combines community-run accommodation and public spaces, operated by trained young people and women, with astronomy as the central attraction. Through this approach, local communities can benefit directly from the income derived from stargazing activities and the cultural experiences offered to visitors. This model is not limited to astronomical observation alone, but encompasses holistic experiences that include cultural heritage, local crafts, sustainable living and ecotourism.

Background

Ladakh, located at an altitude of over 3,000 metres, is known for its breathtaking Himalayan landscapes, its rich Buddhist heritage and its exceptionally clear night skies. In this context, astrotourism offers a unique opportunity to economically empower remote communities that – although having some of the purest dark skies in the world – are often excluded from conventional tourism. Taking advantage of this natural resource can drive socioeconomic transformation, generating new opportunities for income and economic stability. In addition, this strategy contributes to the preservation of the natural environment, consolidating itself as a tool for sustainable development for remote communities globally.

Pilot initiative

One of the most effective ways of integrating astrotourism into rural communities is through cultural experiences led by the local inhabitants, who guide visitors in astronomical observation activities. A prominent example is the programme implemented in the village of Maan, near Lake Pangong in Ladakh, at an altitude of 4,250 metres. In Maan, a group of women from remote villages received training in astronomy, stargazing and hospitality management. Local guides now offer night sky observation sessions using high-quality telescopes, while sharing stories and traditions from the region. This model has benefited dozens of families, by especially empowering women and fostering more inclusive and sustainable tourism.

Cultural and astronomical centres

Inspired by the success of community initiatives in astrotourism, spaces have been developed that integrate local culture and astronomy. For example, centres near Leh offer immersive experiences that combine sky observation with activities such as monastic prayers, tasting of traditional Ladakhi cuisine and exhibitions of local handicrafts. These centres also have museums that integrate scientific knowledge with Buddhist and Tibetan cosmology, weaving local stories into the observation sessions. Visitors can enjoy guided tours of centuries-old monasteries and participate in activities that celebrate

109 More information to astrotourism in Idaia can be found in:

Sharma, V. and Bumra, C. (2024), 'Exploring the potential of astrotourism: A sustainable niche in modern travel', ShodhKosh: Journal of Visual and Performing Arts, volume 5 (6), pp. 3188–3192, DOI: https://doi.org/10.29121/shodhkosh.v5.i6.2024.6195.

Dutta, S. and Bhowmik, G. (2025), 'Astro-tourism in India: A sustainable livelihood approach', International Journal of Social Impact, volume 10 (4), DOI: https://doi.org/10.25215/2455/1004S09.

the connection between the sky and the local culture. In addition, souvenirs and organic products from the region complement the experience, promoting sustainable economic development and preserving community traditions.



Local women operating telescopes in Ladakh, India. © Asgotraa, Sonal

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9.4
Astrotourism in New Zealand

New Zealand has a thriving astrotourism market. The pristine skies of the country had been popular among amateur astronomers since the end of the 20th century. In 2012 New Zealand received its first Dark Sky certification: The Aoraki Mackenzie International Dark Sky Reserve, certified by Dark Sky International, was the first certified sky in the southern hemisphere and the largest in the world for many years. At the time when this publication is drafted, New Zealand counts on eight International Dark Sky Places.

One of the purposes of all these certified Dark Sky Places is promoting astronomical outreach and astrotourism. In the Aoraki Mackenzie Dark Sky Reserve alone, there are about a dozen astrotourism companies, including Tekapo Stargazing, Silver River Stargazing and Big Sky Stargazing in the Aoraki Mountain Cook National Park.

Astrotourism has made a big contribution to the economy of the Mackenzie District, with visitors coming for guided night sky tours numbering about 150,000 per year. The total visitor expenditure derived from astrotourism activities in the Mackenzie District alone is estimated at around USD 22 million annually, according to official government statistics, representing 10% of the total visitor expenditure. In 2024, as one of the leading astrotourism destinations of the country, the Aoraki Mackenzie International Dark Sky Reserve hosted – in collaboration with the Royal Astronomical Society of New Zealand – the New Zealand Starlight Conference at Lake Tekapo, with the aim to push forward a common agenda on light pollution, dark sky protection and astrotourism.

The secret to the success of New Zealand in astrotourism development is a combination of several factors: on the one hand, the small population, especially in the southern island where it barely reaches 1 million people, allows for pristine dark skies; on the other hand, the accessibility of dark places to tourists is very favourable. Last but not least, the willingness of local government authorities to implement lighting ordinances and fight light pollution is remarkable.



Astrotourists at Mountain John Observatory, Lake Tekapo, New Zealand. © Gunn, Fraser

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9.5
Best Tourism Villages by UN Tourism

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"Rural tourism is a type of tourism activity in which the visitor's experience is related to a wide range of products generally linked to nature-based activities, agriculture, rural lifestyle/culture, angling and sightseeing.

"Rural tourism activities take place in non-urban (rural) areas with the following characteristics:

- Low population density;
- Landscape and land-use dominated by agriculture and forestry; and
- Traditional social structure and lifestyle."[110]

In this context, rural tourism can play a key role in revitalizing communities, preserving cultural and natural heritage, and promoting sustainable development. The Best Tourism Villages (BTV) by UN Tourism initiative[111] recognizes outstanding rural destinations that are embracing tourism as a driver of economic opportunity and community well-being, while safeguarding their environmental and cultural assets.

Among the wide range of activities that can enrich the rural tourism offer, astrotourism has emerged as a compelling and sustainable addition. Thanks to their usually low light pollution, open landscapes and potential deep-rooted cultural connections to the cosmos, many rural areas provide ideal conditions for experiences such as stargazing, astrophotography and astronomy education. Beyond its scientific appeal, astrotourism can foster environmental awareness, support local entrepreneurship and encourage year-round visitation.

The villages of Anogeia in Greece, San Cosme y Damián in Paraguay, the Portuguese village of Cumeada and Rupit in Spain – all recognized as Best Tourism Villages by UN Tourism – stand out as inspiring examples of how rural destinations can integrate astrotourism. Each village has leveraged its unique assets to position itself as a destination where visitors can connect with the night sky while engaging with local culture, history and community life.[112]

110 World Tourism Organization (2019), *UNWTO Tourism Definitions*, UN Tourism, Madrid, DOI: https://doi.org/10.18111/9789284420858.

111 For more information on the initiative consult: World Tourism Organization (n.d.), 'Best Tourism Villages by UN Tourism', UN Tourism, Madrid, available at: https://tourism-villages.unwto.org/en/ [15-11-2025].

112 The villages and their participation in the Best Tourism Villages by UN Tourism initiative can be consulted at: World Tourism Organization (n.d.), 'Best Tourism Villages by UN Tourism', UN Tourism, Madrid, available at: https://tourism-villages.unwto.org/en/ [15-11-2025].

Anogeia, Greece: https://tourism-villages.unwto.org/en/villages/anogeia-greece/

San Cosme y Damián, Paraguay: https://tourism-villages.unwto.org/en/villages/san-cosme-y-damian/

Cumeada, Portugal: https://tourism-villages.unwto.org/en/villages/cumeada/

Rupit, Spain: https://tourism-villages.unwto.org/en/villages/rupit/

9.5.1
Anogeia, Greece, BTV 2024[113]

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Anogeia stands out as a natural astronomical observatory thanks to its unique geomorphology, strategic location and unobstructed views of the night sky. This good practice showcases how the village leveraged these assets to promote astrotourism as a niche and sustainable tourism model. With the aim of diversifying the local tourism offer, enhancing the visitor experience and raising awareness of the cultural and natural wealth of the area, Anogeia implemented several actions to position itself as a leading destination for astrotourism in Crete. The initiative brought together the municipality, local associations, residents and international partners, creating economic and educational opportunities while protecting the dark skies of the region.

Located at the foothills of Mount Psiloritis, Anogeia has long been known for its rich cultural heritage and traditional character. However, like many rural areas, it faced challenges such as seasonality, depopulation and limited economic diversification. Its altitude, clean atmosphere and minimal light pollution naturally positioned it for stargazing activities. These attributes, combined with growing global interest in sustainable and experience-based tourism, prompted local stakeholders to consider astrotourism as a viable solution. The initiative aligns with broader sustainability and rural development goals by promoting conservation, education and inclusive growth through tourism.

The development of astrotourism in Anogeia began with the decision of the municipality to capitalize on its astronomical potential. Collaborations were formed with local organizations, educational institutions and astronomy clubs. Infrastructure improvements included the establishment of an observatory, enhancement of trails for night sky viewing and the integration of signage with QR codes offering educational content. Events such as stargazing nights, school visits and workshops further attracted both locals and tourists. The village also engaged in international networks and received external technical support to refine its strategy and gain visibility. Notably, the initiative involved close coordination with the local community, ensuring that traditional knowledge and local identity were preserved throughout.

The efforts in astrotourism have yielded tangible results in Anogeia. There has been a noticeable increase in visitors during the shoulder and off-seasons, contributing to local economic activity. Small businesses, including accommodations and food establishments, benefited from extended stays and niche marketing. The educational value of the initiative has also been considerable, fostering awareness about astronomy and the importance of dark sky preservation among both locals and visitors. Anogeia gained national recognition and became part of broader discussions on thematic tourism development in Greece. The practice also strengthened community bonds and positioned the village as a forward-thinking rural destination that balances tourism development with environmental stewardship.

Implementing astrotourism in a rural setting came with several challenges. Initial limitations in technical expertise, infrastructure and funding were addressed by tapping into external networks and support. Collaborative approaches proved essential in securing the trust and participation of the community. It was also critical to balance tourism promotion with conservation by managing visitor flow and

113 Consult for further information: World Tourism Organization (n.d.), 'Best Tourism Villages by UN Tourism', 'Anogeia', UN Tourism, Madrid, available at: https://tourism-villages.unwto.org/en/villages/anogeia-greece/ [15-11-2025].

raising awareness on dark sky protection. The experience highlighted the importance of starting with small-scale, low-impact interventions and building momentum over time. Other villages interested in developing astrotourism should assess their natural assets, involve local stakeholders from the outset and seek partnerships with experts in astronomy and sustainable tourism.

The journey of the village into astrotourism demonstrates how a rural village can reinvent its tourism model by embracing sustainability and innovation. By focussing on its unique natural assets and engaging the local population, Anogeia created a compelling offer that attracts visitors while respecting the environment and community values. The experiences serve as a model for other rural destinations seeking to diversify their tourism offer, boost local development and contribute to global sustainability goals through niche tourism approaches like astrotourism.

Skinakas Observatory above Anogeia, a UN Tourism Best Tourism Village, Greece. © Ioannis Nektarios Papadakis



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9.5.2
San Cosme y Damián, Paraguay, BTV 2021[114]

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San Cosme y Damián is a district in southern Paraguay whose historical legacy is deeply rooted in the Jesuit missions of the 17th century. Among these missions, San Cosme stands out as a center of scientific innovation thanks to the work of Father Buenaventura Suárez (1679–1750), a prominent Jesuit astronomer who transformed the site into a significant center for astronomical observation in South America. Over time, however, this scientific heritage was largely forgotten – until 2008, when a master plan for tourism development rekindled interest in the historical and scientific potential of the area. As a result, community members, youth groups and local authorities advocated for the creation of the first astronomical center of Paraguay in honor of Father Buenaventura Suárez.

The need to diversify the local economy, strengthen cultural identity and take advantage of the natural and historical wealth of the region provided the foundation for the development of astrotourism as a sustainable strategy. Its implementation has followed a structured and multi-dimensional approach, combining infrastructure investment, community participation and strategic collaboration. Notable developments include the construction and modernization of the Buenaventura Suárez Astronomical Interpretation Centre, which today features professional telescopes, an analog planetarium, an armillary sphere (the only one of its kind in South America) and interactive learning spaces. In addition, partnerships with educational, scientific and tourism institutions have been established to promote both research and the positioning of San Cosme y Damián as a scientific and cultural tourism destination.

Community involvement has played a central role in this process. Local residents have received training as specialized astrotourism guides, with new experiences designed to integrate astronomical knowledge with Guaraní cultural heritage and Jesuit history. The incorporation of technological tools such as astrophotography and digital communication has further expanded the reach and visibility of the project among new audiences.

The introduction of astrotourism has generated significant benefits across economic, cultural and environmental dimensions. Tourism-related activities have contributed to the establishment of the first tourist inns in the area, empowering local women, strengthening local gastronomy and stimulating commerce. From a cultural perspective, there has been a renewed appreciation of the Jesuit legacy, especially the life and contributions of Father Buenaventura Suárez, reinforcing a shared sense of historical identity. Environmental awareness has also increased through the promotion of dark sky conservation and the reduction of light pollution. Furthermore, the development of new professional profiles – including educators, guides and cultural promoters – has created opportunities for community members, particularly young people, some of whom have discovered astronomy as a passion and possible career path.

Success stories include the creation of local entrepreneur associations, such as cooperatives of artisans and vendors, all of which have built businesses around the astrotourism value chain. These initiatives have been complemented by growing academic interest in

114 Consult for further information: World Tourism Organization (n.d.), 'Best Tourism Villages by UN Tourism', 'San Cosme y Damián', UN Tourism, Madrid, available at: https://tourism-villages.unwto.org/en/villages/san-cosme-y-damian/ [15-11-2025].

astronomy, creating a virtuous cycle of education, tourism and community development.

The implementation process has not been without challenges. At the outset, the lack of financial and technical resources, as well as limited awareness of the importance of protecting the night sky, posed significant obstacles. To address these, several strategies have been recommended: establishing strong partnerships with academic and scientific institutions to support research and professional training; adopting local regulations to prevent light pollution and preserve the quality of the night sky; and diversifying astrotourism offerings to attract a broad spectrum of visitors.

The case of San Cosme y Damián demonstrates that astrotourism can serve as an effective catalyst for sustainable rural development. By combining science, history and environmental awareness, it contributes to economic revitalization, the strengthening of cultural heritage and the promotion of conservation practices. Continued efforts of the district to innovate and expand its astrotourism model not only enhance the visitor experience but also ensure the long-term preservation of its unique scientific and historical legacy. In this way, San Cosme y Damián is consolidating its position on the astrotourism map, offering a destination where visitors can engage with the cosmos, the Guaraní sky and a profound narrative of cultural continuity and scientific exploration.



Stargazing at San Cosme y Damián, Paraguay. © Barboza, Angélica

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9.5.3
Cumeada, Portugal, BTV 2021[115]

In the small village of Cumeada, the stars aligned to bring new life to the territory. Since 2016, Cumeada has served as the headquarters of the Dark Sky® Alqueva destination and as the location of its first official observatory. Although considered a risky choice at the time, the intention of the Dark Sky Association was to convey a message in which the balance between the daily life of a community and the protection of the night sky could prevail. As a result, astrotourism has become a hallmark of this small village, with the Official Dark Sky® Observatory installed in a former primary school, now welcoming thousands of astrotourists each year from over 35 nationalities.

Cumeada is located in the municipality of Reguengos de Monsaraz, one of the eleven municipalities that comprise the Portuguese section of the Dark Sky® Alqueva territory – the first in the world to be certified as a Starlight Tourism Destination by the Starlight Foundation and the first cross-border destination to receive this certification. Created in 2007, the destination eventually reached a stage in its development that required the establishment of a headquarters within the certified area and the creation of a dedicated space for astrotourism activities. After careful consideration of various options, Cumeada was identified as the location that could most effectively support the mission of the Dark Sky Association at that point in the evolution of the project. This marked the beginning of the connection between Dark Sky® Alqueva and Cumeada.

The process involved the improvement of public lighting – an essential factor for ensuring the coexistence of community life and sky protection, as well as for enhancing the general well-being of residents. The observatory conducts most of its activities at night, without disturbing the rest of the community, thereby allowing the village to maintain its traditional character during the day and transforming into a village of stars after nightfall. The introduction of astrotourism to this small community, in harmony with its identity and essence, represents a significant component of the strategic plan underpinning Dark Sky® Alqueva. The ability to foster innovation and economic development while preserving the character of the territory constitutes the principal value of the project and its core objective in the pursuit of sustainability in rural areas.

The Dark Sky® Alqueva destination was created in 2007 with the aim of protecting the night sky and implementing an Integrated Sustainable Development Plan. This plan includes the development of astrotourism activities, whether carried out directly by the Dark Sky Association or through its official partner network. Given that the region lacked an established tradition in astronomy and there was limited public awareness regarding the distinction between scientific dissemination and experiential applications of science, it was necessary from the outset to specialize in astrotourism. For several years, activities were conducted without a dedicated physical space; however, growing demand eventually warranted investment in infrastructure. This led to the establishment of a central facility to serve as both the headquarters of the destination and home to its official observatory. The combination of the Dark Sky® mission and the increasing interest in astrotourism resulted in the selection of Cumeada as the main reference point of the destination – a key milestone in the development of Dark Sky® Alqueva.

115 Consult for further information: World Tourism Organization (n.d.), 'Best Tourism Villages by UN Tourism', 'Cumeada', UN Tourism, Madrid, available at: https://tourism-villages.unwto.org/en/villages/cumeada/ [15-11-2025].

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The Milky Way over the Alqueva lake, Portugal, in Dark Sky® Alqueva, Portugal. © Claro, Miguel

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The observatory has recently been expanded due to a significant rise in demand, which has also required an increase in staff to accommodate external sessions. Dark Sky® Alqueva and its Official Dark Sky® Observatory in Cumeada receive thousands of tourists each year from at least 35 countries, who visit not only for the quality of the night sky but also for the high standard of the activities offered. In 2021, the awarding of the Best Tourism Villages by UN Tourism seal was widely recognized by the local population and authorities as a validation of the important role played by Dark Sky® Alqueva and its observatory in the revitalization of the village. This recognition was commemorated in 2022 through the installation of a replica of the award seal in a local roundabout, in a ceremony that engaged the entire community.

Since 2013, Dark Sky® Alqueva has received numerous accolades from a variety of organizations. However, from 2019 onward, the destination gained increasing prominence, receiving over 60 international awards. These include distinctions awarded to the Dark Sky Association, the destination, its founder Apolónia Rodrigues, and the Official Observatory. Further recognition has been granted to the Official Astrophotographer of Dark Sky® Alqueva, Miguel Claro, whose work captures the essence of the destination and, from the observatory, the beauty of the deep sky. His widely shared photographs help to reinforce the mission of promoting the quality of the night sky and contribute to the international visibility of the destination.

Since its establishment, the Official Dark Sky® Alqueva Observatory has experienced consistent growth of between 30% and 40% per year. Excluding the pandemic years, the destination has seen a steady and growing influx of international tourists throughout the year, helping to reduce seasonality.

Developing an astrotourism destination within a dynamic region inhabited by local communities – where diverse and sometimes conflicting interests must coexist – presents significant challenges. In this case, the context is further complicated by the demographic reality of an aging population that retains memories of a time before electricity and often associates lighting with development. Achieving a balanced outcome that allows for growth as an astrotourism destination while enhancing the value of the territory requires persistence, resilience and strategic focus.

A robust, long-term development plan is essential – one that is well structured, capable of adaptation and that maintains its core principles. Equally important is a deep understanding of the region, its social dynamics, stakeholders and their motivations. Clearly defining the factors that contribute to project success allows for sustained focus during critical and challenging periods. In addition, it is vital to understand the motivations of astrotourists and to identify what distinguishes an activity from a memorable experience. Prioritizing quality, even when it represents the more complex and demanding path, is essential to long-term success.

In a rural context characterized by aging demographics and ongoing population decline, the implementation of an innovative and engaging project that enables the coexistence of tradition and modernity constitutes a significant asset for the community. The village of Cumeada now receives thousands of tourists annually, bringing economic benefits without creating pressure or disruption in local daily life. Astrotourism has offered the village a new purpose, transforming it into a true village of the stars while preserving its identity and essence. This balance has been made possible through the nature of astrotourism itself – an activity which, when carefully developed for an appropriate audience, does not disturb the surrounding community.

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9.5.4
Rupit, Spain, BTV 2022[116]

Rupit is a small village of approximately 280 inhabitants, located in the municipality of Rupit i Pruit, in Catalonia, Spain – about 100 km away from Barcelona. Known for its rich cultural and natural heritage, Rupit benefits from a privileged position far from major urban centers, which has enabled the preservation of its dark skies with minimal light pollution. In recognition of these qualities, the regional government of Catalonia awarded Rupit i Pruit the ECNQ distinction – Espai amb Cel Nocturn de Qualitat (Space with a Quality Night Sky) – in 2020.

Aligned with its landscape and environmental values, the local administration has prioritized the protection of the night sky through a set of strategic and sustainable actions. One of the most significant steps has been the modernization of the lighting infrastructure of the village, transitioning toward an environmentally conscious model designed to reduce both energy consumption and light pollution. As part of this commitment, a Light Pollution Prevention Plan is being implemented, with the expectation of reducing energy expenditure by approximately 57%.

In parallel, the "Rupit turns off the lights and turns on the stars" initiative has been launched to promote awareness, environmental education and astrotourism throughout the year. This project encompasses a variety of activities aimed at both residents and visitors:

- Day and night sky observations from the Santa Magdalena viewpoint of Rupit, one of the most iconic natural landmarks, offer participants panoramic views and opportunities to engage with the sky at different times of day.
- A night photography contest and workshop combine scientific curiosity with artistic expression, equipping participants with techniques to capture the beauty of the starry sky while engaging in friendly competition.
- Activities dedicated to International Women's Day celebrate the contributions of women to astronomy, underlining their historical and contemporary roles in advancing science and space exploration.
- Dinners under the stars, organized in collaboration with local tourism operators, provide visitors with a unique gastronomic experience set beneath a dark, starlit sky.
- The exploration of the universe via a mobile planetarium introduces participants to the cosmos through an immersive, educational journey designed to spark curiosity across all age groups.
- The discovery of nocturnal wildlife and the impact of light pollution offers an interpretive tour to raise awareness about local nocturnal species and how artificial light affects their habitats and behaviour.
- Astronomy workshops for children deliver hands-on, accessible learning experiences tailored for younger audiences, with the goal of igniting interest in space and science from an early age.
- A fixed planetarium installation supports autonomous sky observation, expanding the range of accessible astronomical experiences in the village.

116 Consult for further information: World Tourism Organization (n.d.), 'Best Tourism Villages by UN Tourism', 'Rupit', UN Tourism, Madrid, available at: Rupit, Spain: https://tourism-villages.unwto.org/en/villages/rupit/ [15-11-2025].

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- The Path of the Stars, a self-guided family route, features Rupes, the village mascot, and his glow-worm companion, leading participants through an educational journey under the night sky.

These initiatives are the result of a collaborative effort between public entities and the private tourism sector, actively engaging the local community and enhancing the position of Rupit as a destination for sustainable and experiential tourism. In this context, astrotourism in Rupit contributes to several objectives aligned with the United Nations SDGs: it supports the conservation of biodiversity and natural landscapes (SDG 15), it promotes quality environmental education and climate action (SDGs 4 and 13), it encourages responsible consumption and tourism (SDG 12), it strengthens the local economy through sustainable practices (SDG 8), it fosters the use of energy-efficient technologies (SDG 7), and it raises global awareness of the importance of space and environmental stewardship (SDGs 14 and 17).

Implementing astrotourism in a small rural village with limited infrastructure and demographic challenges requires careful planning, broad collaboration and a shared long-term vision. In this context, the preservation of dark skies has served not only as an environmental objective but also as a tool for community engagement, education and economic diversification. The initiative illustrates the importance of understanding the specific characteristics of the region and involving all stakeholders to ensure success. Equally essential is the commitment to quality programming and the development of tourism products that contribute to local well-being without compromising the identity of the area.

The case of Rupit demonstrates how the conservation of the night sky can be effectively integrated with cultural, environmental and economic strategies. Through the enhancement of its lighting system, the development of awareness-raising and educational programmes, and the strategic positioning of the village as a center for astrotourism, Rupit i Pruit not only protects its natural assets but also promotes responsible tourism and contributes to rural sustainability. The Rupit turns off the lights and turns on the stars initiative thus stands as a model for the integration of astrotourism with sustainability principles, fostering a respectful and inclusive approach that benefits both the local population and visitors alike.



Milky Way over Rupit, a UN Tourism Best Tourism Village, Spain. © Hervias, F.



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10 Guidelines for member states and tourism destinations

Astrotourism offers destinations a unique opportunity to combine scientific discovery, environmental stewardship and meaningful visitor engagement. To support its member states and tourism stakeholders in harnessing the potential of astrotourism, UN Tourism prepared the following practical guidelines spanning infrastructure development, light pollution management, strategic site planning, education, community involvement and experience design. These guidelines aim to help destinations build sustainable, inclusive and high-quality astrotourism offerings while protecting the integrity of the night sky as a natural and cultural asset.

Stargazing under the night sky in Namibia. © Anton Nazarov | Dreamstime.com

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1. Sustainable infrastructure and site development

Build and repurpose astrotourism facilities

Develop or adapt infrastructure such as observatories, planetariums, stargazing platforms and interpretation centres. Prioritize sustainable, accessible and inclusive design from the outset, and consider repurposing abandoned buildings for astrotourism use to reduce resource consumption.

Improve transport and accessibility

Ensure remote stargazing areas are reachable. Include Universal Design elements to accommodate visitors of all abilities, with tactile maps, captioned content and structured environments for neurodiverse visitors.

Integrate astrotourism in protected natural landscapes

Incorporate astrotourism into the planning and management of natural protected areas. Treat the nightscape as a valuable ecological and cultural asset, and promote experiences that blend sky observation with ecological and heritage appreciation.

Enhance amenities for stargazing comfort

Facilities may include the availability of specialized equipment such as binoculars, telescopes and star charts, as well as blankets and hot beverages to enhance comfort while stargazing.

Adapt services to night-time tourism

Since astronomical observation often keeps astrotourists out late, accommodations should consider offering late breakfast and late check-out options. Other recommended services include guided night tours and the flexibility to host themed events and workshops on the premises.

2. Light pollution control and sky protection

Promote smart lighting technologies

Support the adoption of intelligent, energy-efficient lighting systems that minimize light spill and prioritize dark sky preservation. Use innovation to enhance safety and visitor experience without harming night visibility.

Enforce light pollution regulation

Develop regulatory frameworks at local, regional and national levels to control artificial light emissions, balancing astronomical, environmental and aesthetic criteria. Harmonization across jurisdictions is key.

Adopt international standards and certifications

Encourage destinations to pursue certifications like Starlight or similar schemes that reward effective dark-sky protection. Implement regular monitoring and transparent standards to maintain quality and sustainability.

3. Strategic site planning and phenomenon-based tourism

Designate and equip astronomical viewpoints

Establish networks of dark-sky viewpoints in optimal locations, equipped with interpretative materials, seating and basic services. Guided programmes and local involvement enhance their value.

Plan around celestial events

Integrate major astronomical events (eclipses, meteor showers, etc.) into destination marketing and infrastructure planning. Offer special packages with photography workshops, expert talks and themed lodging to attract global visitors and extend tourist seasons.

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4. Education, interpretation, and storytelling

Blend astronomy with cultural heritage

Use storytelling to connect astronomy with mythology, indigenous knowledge and local traditions. Offer multimedia experiences, guided cultural tours or G-astronomy nights combining gastronomy and star myths.

Incorporate astronomy into formal education

Promote sky literacy by including astronomy and space sciences in school curricula. Early education fosters scientific curiosity and long-term support for dark sky conservation.

Offer training for tourism professionals

Provide targeted training for guides, entrepreneurs and tourism managers in astrotourism. Professionalization ensures quality visitor experiences and responsible resource management.

5. Community engagement and collaborative governance

Foster public-private and community partnerships

Establish cooperation between tourism bodies, scientific institutions, businesses and local communities. Collaborative governance supports innovation, inclusivity and long-term resilience.

Involve scientists in experience design

Leverage insights from astronomers, conservationists and meteorologists to shape astrotourism experiences and destination planning. Create citizen science programmes to engage visitors in meaningful contributions.

Promote research and data-driven innovation

Support studies that examine the social, cultural, economic and environmental dimensions of astrotourism. Use this data to guide policymaking, improve practices and foster technological innovation.

6. Emotional and experiential value

Leverage the wow! factor and human curiosity

Design experiences that immerse visitors in the grandeur of the cosmos. Include telescope sessions, immersive planetarium shows and hands-on materials and activities like astrophotography or meteorite handling to spark wonder and reflection. Capitalize on the philosophical and emotional impact of stargazing to transform astrotourism experiences into unforgettable journeys.

Blend astrotourism with diverse travel interests

Adapt to broader audiences by integrating astrotourism with nature, adventure, wellness, cultural and culinary tourism. Examples include yoga under the stars, desert safaris, night kayaking or stargazing paired with local cuisine and folklore.

Glossary

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To aid understanding of this publication, this glossary provides a list of specialized terms related to astronomy and astrotourism, as well as key concepts on dark skies and the factors influencing the quality of night skies for astronomical observation. The terms and definitions presented herein are offered for informational and contextual purposes only. They do not constitute official or authoritative terminology and should not be interpreted as formal standards or technical classifications.

Archaeoastronomy:[117] field that studies how ancient peoples understood, used and interpreted the sky and celestial phenomena in their cultures.

Asterism:[118] a recognizable pattern or group of stars that forms a distinct shape in the night sky but is not one of the 88 official constellations. Asterisms can be part of a constellation (like the Big Dipper within Ursa Major) or span multiple constellations (like the Summer Triangle). They are commonly used in stargazing to help navigate the sky and identify celestial objects.

Astrology:[119] the study of how the positions and movements of the stars, Sun, Moon, and planets are believed to influence human events and behaviour.

Astronomical heritage:[120] evidence of human relationships with the sky, including sites, monuments, instruments, knowledge and practices that reflect how people have observed, used or interpreted celestial phenomena throughout history.

Astronomical seeing (units arc-sec**):**[121] refers to the blurring or instantaneous image broadening of astronomical objects caused by turbulent mixing in the atmosphere of the Earth due to variations of the optical refractive index. Good seeing conditions mean objects appear sharp and steady, while poor seeing conditions cause stars to twinkle and objects to blur.

Astronomical viewpoint:[122] a location selected for the observation of celestial objects under favourable conditions, potentially equipped with orientation aids (e.g. star maps, or informational panels), from which observers can view stars, planets, constellations and so forth.

Astronomy:[123] scientific study of the universe and all objects and phenomena beyond the atmosphere of the Earth, such as stars, planets, galaxies and other celestial bodies.

117 Merriam-Webster (2025), 'Archaeoastronomy', *Merriam-Webster Dictionary,* Springfield, available at: www.merriam-webster.com/dictionary/archaeoastronomy [18-12-2025].

118 Gregersen ,E. (2025), 'Asterism', *Encyclopaedia Britannica*, Chicago, available at: www.britannica.com/science/asterism-astronomy [18-12-2025].

119 Encyclopaedia Britannica (n.d.), 'Astrology', *Encyclopaedia Britannica*, Chicago, available at: www.britannica.com/dictionary/astrology [18-12-2025]

120 United Nations Educational, Scientific and Cultural Organization (n.d.), 'What is astronomical heritage?', UNESCO, Paris, available at: https://web.astronomicalheritage.net/index.php/about/what-is-astronomical-heritage [18-12-2025].

121 Instituto de Astrofísica de Canarias (n.d.), 'Seeing', IAC, La Laguna, available at: www.iac.es/es/observatorios-de-canarias/calidad-del-cielo/parametros-de-calidad-del-cielo/seeing.

122 Star Island La Palma (n.d.), 'Astronomical Viewpoint', Star Island La Palma, Santa Cruz de La Palma, available at: www.starsislandlapalma.es/en/walking-and-observing/astronomical-viewpoint/ [23-12-2025].

123 Encyclopaedia Britannica (2025), 'Astronomy', *Encyclopaedia Britannica*, Chicago, available at: www.britannica.com/science/astronomy [23-12-2025].

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Astrophotography:[124] photography or imaging of astronomical objects, celestial events or areas of the night sky – such as stars, planets, nebulae, galaxies, meteor showers or eclipses – often using long exposure times and specialized equipment (telescopes, sensitive cameras) to capture details not visible to the naked eye.

Astrotourism:[125] type of tourism activity that involves night and day sky observation, educational outreach, scientific research and leisure activities related to astronomy.

Atmospheric transparency:[126] measure of how much light from astronomical objects is transmitted through the atmosphere of the Earth without being absorbed or scattered by clouds, aerosols, dust or humidity. High transparency allows fainter objects to be observed more easily.

Atmospheric turbulence:[127] irregular and chaotic fluctuations in air movement within the atmosphere, which can impact visibility and observational conditions.

Aurora:[128] luminous phenomenon that consists of streamers or arches of light appearing in the upper atmosphere of a the magnetic polar regions of a planet caused by the emission of light from atoms excited by electrons accelerated along the magnetic field lines of the planet.

Celestial equator:[129] great circle on the celestial sphere midway between the celestial poles. It results of the projection of the equator of the Earth into space, dividing the celestial sphere into the northern and southern hemispheres.

Celestial phenomena:[130] also known as astronomical phenomena, observable events among objects in space.

Cloud cover:[131] fraction of the sky obscured by clouds, expressed as a percentage.

Clutter:[132] excessive grouping of bright lights, often found in urban areas, which can create confusion and distractions. Clutter can contribute to glare and skyglow, compounding the overall impact of light pollution.

Constellation:[133] a specific area or region of the celestial sphere with defined boundaries, not merely a pattern of stars. The entire sky is officially divided into 88 such contiguous regions.

Dark sky oases:[134] often referred to as dark sky places, locations where the night sky is protected by an

124 Merriam-Webster (n.d.), 'Astrophotography', *Merriam-Webster Dictionary*, Springfield, available at: www.merriam-webster.com/dictionary/astrophotography [18-12-2025].

125 Starlight Foundation (2021), 'The Astrotourism by the Starlight Foundation', Starlight Foundation, San Cristóbal de la Laguna, available at: https://en.fundacionstarlight.org/ [08-12-2025].

126 Instituto de Astrofísica de Canarias (n.d.), 'Transparency', IAC, La Laguna, available at: www.iac.es/es/observatorios-de-canarias/calidad-del-cielo/parametros-de-calidad-del-cielo/transparency [18-12-2025].

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outdoor lighting policy – or, in legal terms, a lighting ordinance – which limits the amount and the wavelengths of light that shines upwards into the sky.

Deafblind fingerspelling:[135] tactile communication method where letters of the manual are formed as specific handshapes and spelled out directly into the palm of a deafblind person's hand, allowing them to feel words and sentences for communication by touch alone, often used by those losing sight and hearing later in life.

Declination:[136] in astronomy, the angular distance of a celestial object north or south of the celestial equator, analogous to latitude on Earth, and is measured in degrees, arcminutes, and arcseconds. It is used to locate celestial objects in the sky.

Eclipse:[137] complete or partial obscuring of a celestial body by another, occurring when three celestial objects become aligned.

Ecotourism:[138] a type of nature-based tourism activity in which the visitor's essential motivation is to observe, learn, discover, experience and appreciate biological and cultural diversity with a responsible attitude to protect the integrity of the ecosystem and enhance the well-being of the local community. Ecotourism increases awareness towards the conservation of biodiversity, natural environment and cultural assets both among locals and the visitors and requires special management processes to minimize the negative impact on the ecosystem.

Favourable weather conditions:[139] ideal weather conditions for astrotourism destinations to provide visitors with reliable and high-quality stargazing experiences, determined by low or inexistent cloud cover, little or absent wind and mild temperature.

Frequency modulation system:[140] assistive listening device (ALD) that uses FM radio waves to transmit localized speech to a localized listener, in a comparable way to how a radio station uses waves to transmit audio from a speaker into someone's radio. It enhances the use of hearing aids and also assist people who are hard of hearing but do not wear hearing aids, in articular over distance and in noisy environments.

Geology:[141] the study of the rocks and physical processes of Earth in order to understand its origin and history.

Glare:[142] intense and blinding light that reduces visibility. A light within the field of vision that is brighter than the brightness to which the eyes are adapted.

Hearing induction loop:[143] assistive listening system that helps people who use a hearing aid, loop listener, and cochlear implants to hear sounds more clearly by reducing or cutting out background noise.

Light pollution:[144] alteration of natural night light levels caused by artificial light sources. This pollution manifests in several forms, including skyglow, glare, light trespass and clutter.

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Light trespass:[145] the unwelcome spill of artificial light into spaces where it is neither needed nor desired.

Low Earth orbit:[146] an orbit that is relatively close to the surface of the Earth, normally at altitudes between 160 km and 1000 km above the surface of the Earth.

Lunistice:[147] in cultural astronomy, it refers to the extremes in the declination of the Moon – the furthest northern and southern positions the Moon reaches relative to the celestial equator over its long (~18.6year) cycle.

Meteor shower:[148] celestial event in which several meteors are observed to radiate from one point in the night sky.

Meteor:[149] light phenomenon which results from the entry of a solid particle from space into the atmosphere of the Earth.

Naked-eye observation:[150] direct experience of viewing celestial objects and phenomena in the night sky without the use of optical aids such as telescopes or binoculars, emphasizing firsthand observation and personal engagement with the starry sky.

Night sky photography:[151] style of photography that focusses on capturing images of the celestial features of the night sky – such as stars, planets, the Milky Way, meteors, auroras and other astronomical phenomena – typically requiring specialized techniques like long exposures and work in lowlight conditions to reveal details not easily seen by the unaided eye.

Nightscape:[152] a view of an area at night or a work of art that represents this.

Paleontological tourism (or paleotourism):[153] a form of tourism that involves visiting sites with significant paleontological heritage – such as fossil locations, museums with fossil displays or landscapes shaped by ancient life – for educational, recreational and experiential purposes, drawing on the interest in the past of the Earth and its fossil record.

Path of totality:[154] narrow track on the surface of the Earth where – during a total solar eclipse – the umbral shadow of the Moon completely covers the Sun, allowing observers within that band to experience total darkness (totality) and see the solar corona.

Planetarium:[155] theater or facility designed to present educational and entertaining shows about astronomy and the night sky, often using a domed ceiling to

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project stars, planets and other celestial phenomena, helping audiences understand astronomical concepts.

Quality dark sky:[156] night sky that is relatively free of artificial light pollution and retains its natural darkness, such that celestial objects like the Milky Way are visible with the unaided eye and there is minimal skyglow or glare from artificial lighting.

Rural tourism:[157] a type of tourism activity in which the visitor's experience is related to a wide range of products generally linked to nature-based activities, agriculture, rural lifestyle / culture, angling and sightseeing. Rural tourism activities take place in non-urban (rural) areas with the following characteristics: low population density; landscape and land-use dominated by agriculture and forestry; and traditional social structure and lifestyle.

Scientific observatory:[158] facility or structure equipped for observing natural phenomena, most commonly celestial objects, the atmosphere or geophysical processes, using specialized instruments and technologies. Observatories serve research, monitoring and educational purposes in astronomy, meteorology and related sciences.

Scientific tourism:[159] tourism approach that integrates scientific research and knowledge into tourism activities, linking researchers, local communities and visitors to the production, interpretation and dissemination of scientific knowledge.

Skyglow:[160] brightening of the night sky that results from the scattering and reflection of light from the constituents of the atmosphere (gaseous molecules and aerosols), in the direction of stars and other celestial objects, primarily caused by urban lighting.

Solstice:[161] either of the two moments in the year when the apparent path of the Sun is farthest north or south from the equator of the Earth.

Stargazing:[162] the activity of looking up at the stars and objects in space as a hobby, as part of scientific study or as part of astrology.

Stratospheric flight:[163] in the context of tourism, a stratospheric flight refers to a high-altitude travel experience that transports tourists into the stratosphere, typically above 18 km to 20 km, using specialized vehicles such as stratospheric balloons or high-altitude aircraft.

Suborbital flight:[164] flight up to a very high altitude – more than 100 km above sea level – during which, however, the vehicle concerned does not enter orbit (i.e., does not reach an orbital velocity of more than 11.2 km/s).

Wildlife watching:[165] tourism that is undertaken to view and/or encounter wildlife in a natural setting.

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List of acronyms and abbreviations

AM-PPC	Affiliate Members and Public–Private Collaboration Department (UN Tourism)
IAU	International Astronomical Union
IAC	Instituto de Astrofísica de Canarias (Institute of Astrophysics of the Canary Islands)
ICD-11	International Classification of Diseases, 11th Revision (World Health Organization)
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
IUCN WCPA	International Union for Conservation of Nature – World Commission on Protected Areas
LEO	low Earth orbit
SDGs	Sustainable Development Goals
SIT	Special Interest Tourism
SMEs	small and medium-sized enterprises
UN	United Nations
UN Tourism	World Tourism Organization
UNWTO	World Tourism Organization (former name of UN Tourism)
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNEP	United Nations Environment Programme
WCPA	World Commission on Protected Areas
WHO	World Health Organization
WMO	World Meteorological Organization

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The Starlight Foundation is an international non-profit organization founded in 2009 by the Institute of Astrophysics of the Canary Islands (IAC) to promote astronomy and safeguard the night sky as a scientific, cultural and natural heritage. The Foundation works globally to foster responsible tourism, raise awareness of light pollution and support policies aimed at preserving dark skies. Through its internationally recognized certification system, the Starlight Foundation has awarded more than 300 certifications worldwide, covering over 160,000 km² of protected territory and has trained more than 3,000 professionals.

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