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**ГЕОГРАФИЧЕСКИЕ АСПЕКТЫ СИСТЕМАТИЧЕСКОГО РАЗВИТИЯ  
АСТРОТУРИЗМА В УЗБЕКИСТАНЕ. (В СЛУЧАЕ РЕГИОНА  
АРАЛЬСКОГО МОРЯ)**

*Аннотация:* В данной статье описаны географические аспекты развития астротуризма, являющегося нетрадиционным направлением туризма, в ряде туристических дестинаций Узбекистана, в том числе в регионе Аральского моря.

*Ключевые слова:* Астротуризм, регион Аральского моря, солнечные дни, тур операторы, астропоселения, небесные тела, обсерватория, шкала Боргла, световое загрязнение, инфраструктура, Бескала, Аральское море, географические атрибуты.

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**GEOGRAPHICAL ASPECTS OF SYSTEMATIC DEVELOPMENT  
OF ASTROTURISM IN UZBEKISTAN. (IN THE EXAMPLE OF ARAL  
SEA REGION)**

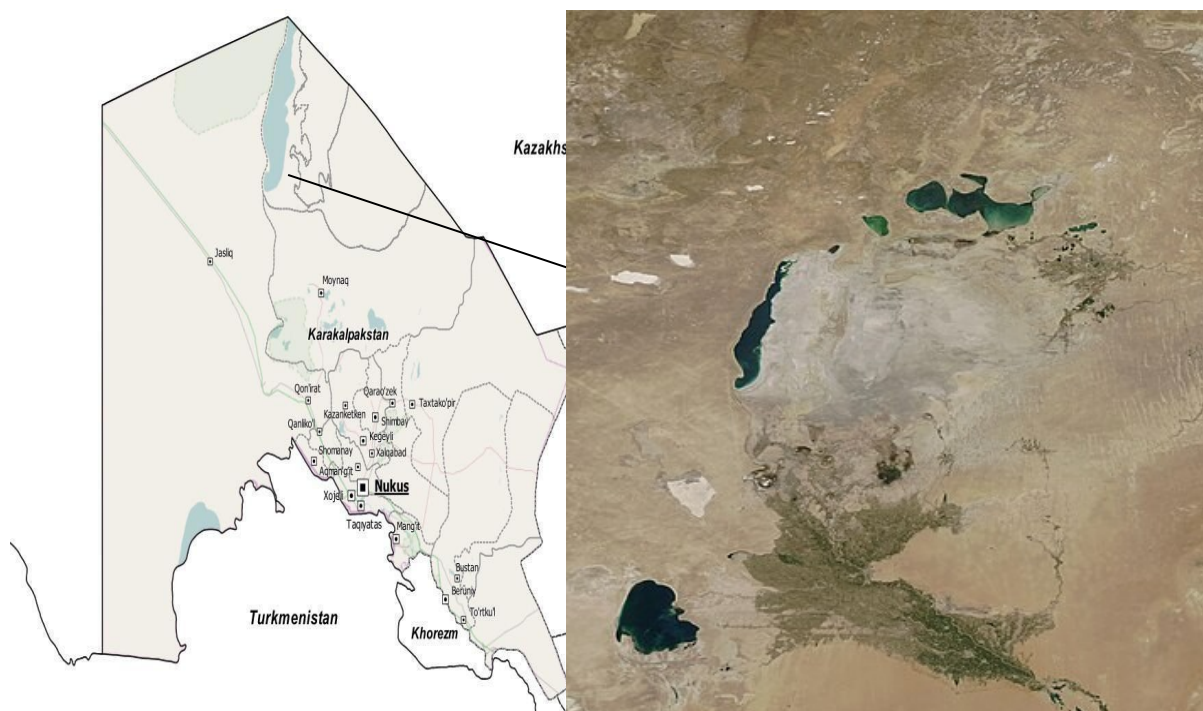
*Abstract:* This article describes the geographical aspects of the development of astrotourism, which is a non-traditional direction of tourism, in several tourist destinations of Uzbekistan, including the Aral Sea region.

*Key words:* Astrotourism, Aral Sea region, astrovillages, sunny days, tour operators, celestial bodies, observatory, Bortle scale, light pollution infrastructure, Beskala, Arol sea, geographical attributes.

## INTRODUCTION.

Astrotourism involves traveling to special destinations for stargazing and sky observation. Tourists look for places with minimal light pollution, clear skies and favorable atmospheric conditions. Astrotourism is a non-traditional form of tourism that arouses interest among astronomers and astronomy lovers, and tourists in general. Astrotourism activities include stargazing, observing meteor showers, and experiencing celestial phenomena. Due to the abundance of sunny days and clear skies in the Aral Bay region, the formation, management and development of the astrotourism industry in this area creates the ground for a rapid increase in the flow of tourists. [1]

## LITERATURE ANALYSIS AND METHODOLOGY.



(Fig. 1.1. Republic of Karakalpakstan and Aral Sea region)

As a result of the reforms implemented in the field of tourism in Uzbekistan in recent years, the number of operating tourist enterprises is increasing year by year. In particular, the number of tour operators operating in 2023 was 1482, of which there are 26 in the Aral Sea region and the Republic of Karakalpakstan, and 58 in the Khorezm region [4]. In January-July 2023, a total

of 3.7 million foreign citizens visited Uzbekistan for tourist purposes. This was reported by the information service of the Statistics Agency. During this period, the largest number of visitors came from Tajikistan (1,151,400), Kyrgyzstan (912,800) and Kazakhstan (879,000). 417,400 people came from Russia for the purpose of travel, while Turkey's figure was 58,000. In addition, 39,600 tourists from Turkmenistan, 20,200 from South Korea, 20,000 from India, 17,700 from China, and 14,100 from Germany visited Uzbekistan. For comparison, in the same period of 2022, the figure was 2.4 million people [8]. The largest flow of foreign citizens to our republic is recorded from the following countries was carried out: from Kazakhstan - 1,076,100 people (from the total number of foreign citizens who entered made up 30.0%), from the Kyrgyz Republic – 952.2 thousand people (26.54%), from Tajikistan - 950.3 thousand people. (26.49%), from Russia – 395 thousand people (11.01%), from Turkey - 53.2 thousand people (1.48%), from Germany - 13.4 thousand people (0.37%), from South Korea - 13.2 thousand people (0.37%), from the Republic of Belarus - 10.4 thousand people (0.29%), from the USA - 9.8 thousand people (0.27%), from India - 9.2 thousand people (0.26%), from Israel - 8.4 thousand people (0.24%), from France - 8.1 thousand people (0.23%), from Ukraine - 7.8 thousand people (0.22%) and 7.6 thousand people (0.21%) from Great Britain. The rest 72.5 thousand people (2.02%) came to Uzbekistan from other foreign countries [7]. These numbers, in turn, allow for the systematic creation of unusual forms of tourism, in particular, astrotourism.

One of the most important factors developing the field of astrotourism is more sunny and clear days. If we look at statistical data, due to the fact that the territory of Uzbekistan stretches 925 km from north to south, the sun's rays do not fall equally on all its parts. If the sun falls at an angle of 71-72° in the summer (on June 22) in the northern part, it is 76° in the south. Therefore, the sun shines 2500-2800 hours a year in the north, and 3000-3100 hours in the south. This means that the sun shines on the territory of Uzbekistan for 280-320 days. The abundance of sunny days and the clear night sky on the island can

have a significant impact on the development of astrotourism [8]. Here are a few ways that this favorable weather can contribute to the potential of astrotourism:

1. Ideal conditions for stargazing: Clear skies and minimal cloud cover of the Aral Sea region provide ideal conditions for stargazing and astronomical observation. With a consistent view, visitors are able to observe celestial phenomena, including stars, planets and meteor showers, unobstructed by atmospheric noise.

2. Astrophotography Opportunities: Clear skies and ample sunlight offer optimal conditions for astrophotography, allowing enthusiasts to capture stunning images of the night sky and celestial bodies. The absence of light pollution and atmospheric disturbance further increases the possibilities of high-quality astrophotography in the Aral Sea region.

3. Astronomy and Educational Programs: Favorable weather conditions along the archipelago provide opportunities for astronomy educational programs, workshops, and stargazing events. Visitors can engage in hands-on astronomy learning experiences, guided observations, and lectures while taking advantage of the region's conducive environment for astronomical research and exploration.

4. Night tourism activities: availability of clear skies and sunny days extends into the night hours, which helps to organize night tourism activities based on stargazing and astronomy. Tour operators can design specialized tours, camping expeditions and stargazing excursions that take advantage of the region's natural conditions for astrotourism.

5. Development of sustainable tourism: Development of astrotourism in the archipelago region is consistent with the principles of sustainable tourism. By taking advantage of the region's favorable weather conditions for stargazing, stakeholders can support environmentally conscious tourism initiatives that reduce the impact on the local ecosystem and provide an innovative solution for visitors. [2]

<b>№</b>	<b>The name of month</b>	<b>Number of sunny days (per day)</b>
1.	January	17
2.	February	16
3.	March	13
4.	April	21
5.	May	29
6.	June	28
7.	July	31
8.	August	31
9.	September	30
10.	October	26
11	November	20
12.	December	14
	<b>Total</b>	<b>276 day</b>

(Table 1.2. The number of sunny days in Aral Sea region observed in 2023) [5]

Astrotourism travel destinations include astrovillages, various villages with less light pollution, observatories, national parks, any area with clear dark skies. An astrotourist is someone who engages in solar eclipse viewing, stargazing, dark sky viewing, and astronomical research, and you can easily recognize them when you see tourists carrying telescopes or binoculars. In fact, astrotourism was on the rise long before the advent of COVID-19, as the rise of urbanized cities has resulted in most of the world's population living in areas with heavy light pollution and no visibility of the night sky. But the pandemic has created even more interest in the night sky, because for people who spend most of their time indoors or can only go out to limited places, the sky is the only limitless space. During the travel ban, stargazing in the park became the most popular activity, and in the short and medium term, especially after tourism has resumed, many people have expressed a desire to visit such areas again. [3]

It is manifested in the specific features of astrotourism:

- **Dark Sky Destinations:** These are designed for past light pollution, providing optimal conditions for the stars and celestial bodies for the time. For example, nationals, remote islands and high mountains.
- **Observatories and Planetariums:** Astrotourists often visit observatories and planetariums to experience advanced telescope tours and astronomy educational programs.
- **Stargazing tools:** Many astrotourism destinations host star nights and festival booths, a place for both novice and experienced stargazers to gather and share their wonder.
- **Educational programs:** Astrotourism often includes educational components such as seminars, lectures, and tours led by astronomers or experts in the field.
- **Celestial Events:** Travelers can plan trips around certain events such as solar or lunar eclipses, meteor showers, or the appearance of certain exoplanets.

These aspects are harmoniously connected to each other. The development of such directions of astratourism in the Aral Sea region is more important and urgent than ever. This is for the systematic development of

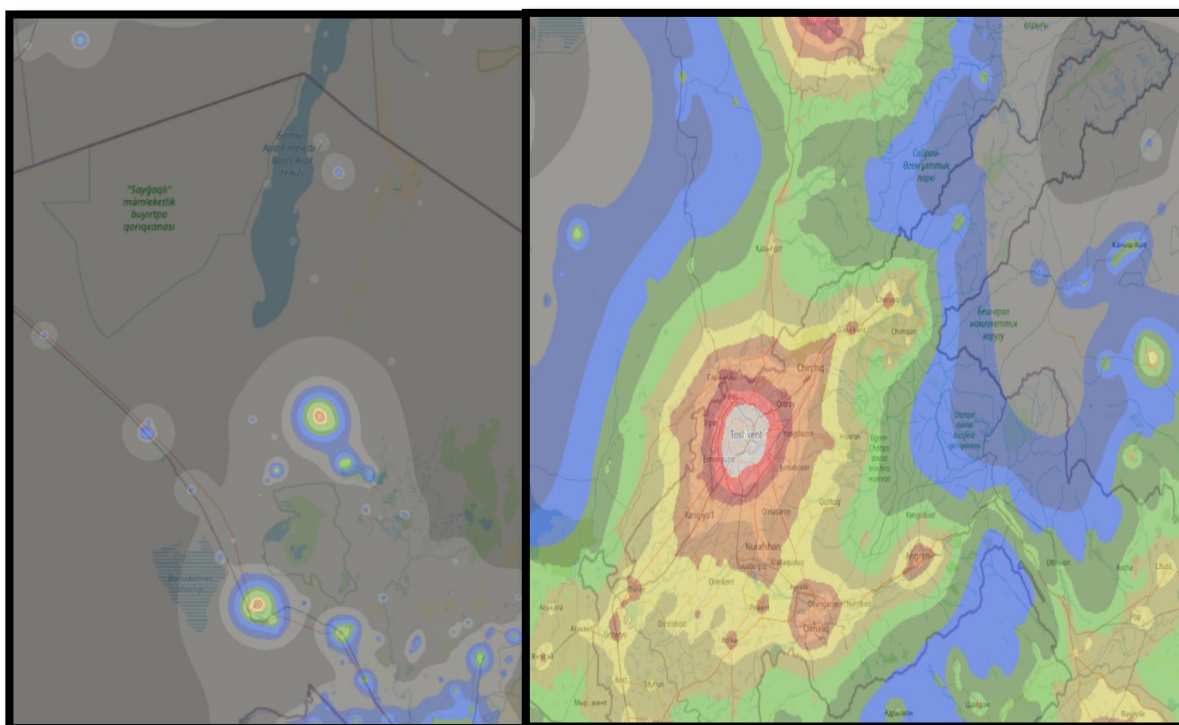


astrotourism in the (Fig.1.3. Remarkable astronomical objects in the territory of Uzbekistan) [6]

Aral Sea region infrastructure also requires consideration of natural, social and economic factors.

Astronomy in Uzbekistan from the Ulugbek observatory in Samarkand. In the 1420s, by the Timurid era astronomer Mirzo Ulugbek, this place was considered one of the best observatories in the world by scientists. Islamic astronomers who worked at the observatory include Al-Koshi, Ali Kushchi and Ulugbek himself. The observatory was destroyed in 1449 and rebuilt in 1908. [6]

## RESULTS AND DISCUSSION



1)

2)

(Fig. 1.4. Level of light pollution according to the Bortle scale in 1) Aral Sea, Ustyurt regions and 2) Tashkent city) [9]

Degree	Artificial / natural sky security	Bortle scale	Description
	<0.01	1	<u>The main theoretical safety of the sky is the air</u> and stargazing
	0.01 to 0.06	2	The rising Milky Way fools some into thinking it's dawn. There is a range of 7.6 to 8.0 for people with individual vision issues.
	0.06 to 0.11	2	Faint shadows from the Milky Way appear on white objects. The Milky Way has faint stretches about 50 degrees thick. Limited size 7.1 to 7.5.
	0.11 to 0.19	3	
	0.19 to 0.33	3	The sky is full of stars, stretching to the horizon in all directions. If there is no fog, it can be seen on the horizon. . The stars look big and close. Low light domes on the horizon (10 to 15 degrees)
	0.33 to 0.58	4	A glow is visible on the horizon in the direction of one or more cities. About the clouds near the city light.
	0.58 to 1.00	4	Milky Way multi-level linear structure view, Limited magnitude 6.2 to 6.5.
	1.00 to 1.73	4.5	Clouds are gray at the zenith and are visible in the direction of one or more prominent city lights. Limited size 5.9 to 6.2.
	From 1.73 to 3.00	4.5	
	3.00 to 5.20	5	Great for city dwellers, but contrast levels are high and subtly lost. At a finite size level. The stars no longer seem large and close. The Milky Way has washed away at the zenith and is not visible on the



			horizon. Clouds help from the sky. Limited magnitude 5.6 - 5.9.
	5.20 to 9.00	5	
	From 9.00 to 15.59	6	Colorless near the horizon in the direction of the sky and cities. The sky looks dull black. The Milky Way is very faint at the zenith. The sky is heavy up to 35 degrees. Limited size 5.0 to 5.5.
	From 15.59 to 27.00	7	
	27.0 to 46.77	8	All sky or rain. Fewer than 20 stars are visible, visible, limited to planets, accessory stars, and variable stars.
	>46.77	9	The stars are faint and washed out, shrinking to a few hundred. The sky and everywhere is colorless. Diseases occur.

(Table 1.5. Bortle scale) [9]

Astrotourism, that is, the pursuit of heavenly experiences, is gaining popularity all over the world. Uzbekistan, which has a rich history along the Great Silk Road, is becoming a unique astrotourism destination. Below we can get acquainted with the geographical aspects of the development of astrotourism in Uzbekistan:

- Advantages of clear skies. Uzbekistan has vast areas with minimal light pollution, creating ideal conditions for stargazing. The regions of the Republic of Karakalpakstan and part of the Ustyurt plateau are characterized by low population density and minimal urbanization. These areas offer breathtaking views of the night sky, allowing visitors to witness celestial phenomena in all their glory. The Republic of Karakalpakstan and Surkhandarya region have minimal light pollution, with a dark sky index below 20 on the Bortle scale.
- Astronomical legacy. Historical relations of Uzbekistan with astronomy go back many centuries. Prominent scientists such as Al-Farghani,

Abu Rayhan Beruni, Mirza Ulugbek, Qazizada Rumi, Al-Koshi, made a great contribution to the science of astronomy. The city of Samarkand, famous for its magnificent architecture, has astronomical significance. Built in the 15th century, the Ulugbek Observatory adds a historical dimension to astrotourism and attracts those eager to connect with the region's astronomical heritage.

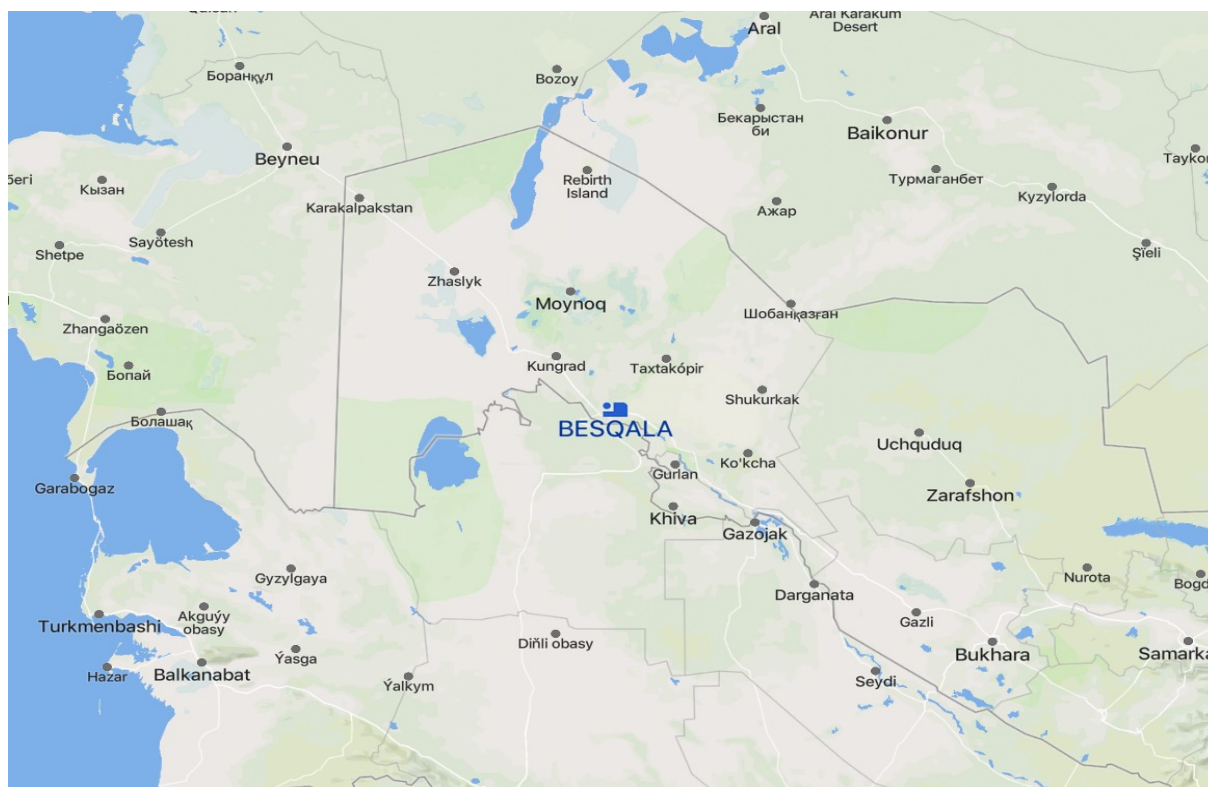
- Rare celestial phenomena. The geographical location of Uzbekistan makes it a convenient place to observe rare celestial phenomena. From meteor showers to lunar eclipses, the country's varied landscapes offer astrotourists a variety of opportunities to witness these events. The Tian Shan mountain range and Qizilqum desert provide a contrasting backdrop for celestial events, creating unforgettable experiences for visitors. The Tian Shan mountain range and Kyzylkum desert offer a variety of landscapes for observing celestial phenomena. Uzbekistan has an average of more than 150 clear nights per year, which creates ample opportunities for stargazers.

- Cooperation with scientific institutions. Uzbekistan's potential for tourism includes cooperation with scientific institutions. Partnerships with observatories and research centers enhance the overall astrotourism experience by providing visitors with advanced astronomical knowledge. This collaboration will also contribute to scientific research and help to better understand the universe.

- Infrastructure development. Geographical aspects also include infrastructure development to support astrotourism. In order to meet the increasing interest of modern tourists in celestial tourism in Uzbekistan, it is important to invest in astronomical objects such as observatories and stargazing platforms. The integration of state-of-the-art technology and astronomy education programs enhances the overall visitor experience.

The famous "Time out" website of Great Britain has published a list of top 10 tourist destinations for "Stargazing" - stargazing in natural areas far from civilization in different parts of the world. Along with the tourist objects of the USA, Chile, New Zealand, and India, the main ecotourism object of

Karakalpakstan, the Ustyurt Plain and the Aral Sea, are also listed on the site. In particular, the special role of ecotourism in combating the drying up of the sea and the consequences of environmental disasters, the "Beskala" tourist enterprise, which has been providing services to foreign tourists for several years, and the complex of meadows along the Aral Sea were described. Tourists can also book a tour to the Aral Sea region to see the sea, visit the complex of herbs and watch the stars at night. [10]



(Fig. 1.6. Beskala tourist zone) [11]

## CONCLUSION

The geographical attributes of the archipelago, the rich astronomical heritage of Uzbekistan, unique sky phenomena, cooperation with scientific buildings and the development of infrastructure serve the rapid development of the field of astrotourism. Opening its doors to stargazers, at the intersection of the Great Silk Road, the celestial domes of the country's trunks capture the imaginations of visitors and mark Uzbekistan as a popular destination for those seeking its entertainment beauty.

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