

# Armenian Astro Tourism Map

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## Abstract

Armenia is a country with rich history, as well as high-level science. It is rich in scientific, particularly in astronomical sites, among which archaeological sites related to science, medieval universities, modern scientific institutions and science related museums can be mentioned. Examples of archaeological sites are ancient observatories, petroglyphs (rock art) of astronomical nature, as well as intangible heritage, such as Armenian calendars and chronology tightly related to the astronomical knowledge. Modern observatories and astronomical institutions having tools or laboratories which can be presented in terms of tourism, are considered as astronomical tourism sites as well. Space museum is astronomy and space science related museum. Despite the fact that Astronomical (Astro) Tourism is a new direction, it has great perspectives, and Armenia has a great potential in this field. It is very important to introduce Armenia from this aspect. In this paper we present major astronomical tourism centers of Armenia and the whole picture as a map.

**Keywords:** *Scientific tourism – Astronomical Heritage – Astro Tourism – Armenian Calendar – Rock Art – Zorats Karer – sundials – Byurakan Astrophysical Observatory.*

## 1. Introduction: Scientific Tourism in the world and in Armenia

Scientific Tourism is a new area not only in Armenia but also in the world. Scientific tourism involves visiting science-related centers. In order to be well organized, it is necessary that the scientific center has proper infrastructure. to be able to present the center to public and in an interesting way. Despite the fact that scientific tourism is a new direction, it has great prospects, and Armenia has great potential in this field. It is very important to present Armenia from this perspective, both science-related archaeological sites and modern institutions and museums.

Conditionally, scientific tourism centers can be divided into 5 groups:

- science-related archaeological sites;
- medieval educational institutions (universities, etc.);
- nature sites;
- modern research institutions;
- scientific or science-related museums.

We have created and published the Scientific Tourism map of Armenia, based on our cognitive tours, studies, and also Internet resources.

Among four of the listed types; archaeological sites, medieval universities, modern research institutions and museums, there are sites having relation to astronomy. Here we give brief description of the Armenian astronomical tourism centres, including those, which are not still active but may serve as sites for scientific tourism.

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## 2. Astronomical Tourism centres in Armenia

There are many petroglyphs (rock art) spread in the territory of Armenia. Armenia is unique from this point of view. Ancient “observatories” or sites, where astronomical observations were made, are also among the astronomical heritage, like Metzamor and Zorats Karer. Armenia is famous with its modern professional observatory, Byurakan Astrophysical Observatory (BAO), and it is unique among dozens of countries to have space museum.

### 2.1. Astronomical archaeological sites of astronomical nature

Here we list the most important ones:

- Metzamor Hill Astronomical Platform and attached historical-archaeological reserve museum
- Zorats Karer (Karahunge) Ensemble; an ancient astronomical observatory
- Geghama Mountains rock art
- Ukhtasar rock art
- Voskehat rock art
- Sundials on monasteries and churches

#### *Metzamor Hill Astronomical Platform*

The ancient settlement of Metzamor is one of the unique monuments of world culture in the territory of which ancient copper and bronze old complexes, sanctuary, supposed observatory, tombs, etc. were excavated. It is located 35 km South-West from Yerevan in Armavir province, not far from Taronik village on the shore of Metzamor River.

Metzamor is one of the possible ancient observatories in Armenia. Metzamor was an ancient town. There was a settlement since V millennium B.C. It was first interpreted as an archaeoastronomical monument in the middle of the 1960s by *Prof. E.S. Parsamian* (1985). There is an observatory out of the fortress. The most probably estimation of the age is 4600 years. As Zorats Karer (Karahunge), Metzamor also needs a better study and proper attitude both from the Armenian government and world archaeoastronomical community.



### *Zorats Karer (Karahunge) Ensemble*

The most fascinating historical astronomical building is Karahunge (the “Armenian Stonehenge”, the name derives from kar “stone” and may mean “singing stones”; and the other famous name is Zorats Karer). It is a megalithic assemblage, 200 km from Yerevan, and 3 km from town Sisian; at an altitude of 1,770 m. The northern latitude is  $39^{\circ}34'$ , and eastern longitude is  $46^{\circ}01'$ . It is an assemblage of many stones put in a circle and a few arms starting from it. As many other such buildings, Karahunge was thought to be a religious assemblage. However, only in the middle of 1980th, Karahunge was first interpreted as an archaeoastronomical monument and was studied by *Prof. E. S. Parsamian* (1999) and *Prof. P. M. Herouni* (1998). Estimations give from 7700 to 4000 years for the age of Karahunge.

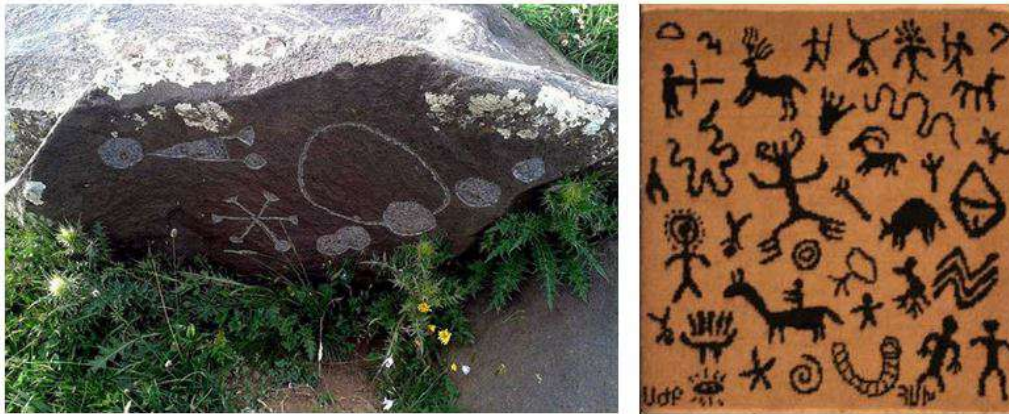


There are 222 stones with a total extent exceeding 250 metres, including 84 with holes (with 4-5 cm diameters). Dozens of astronomical stone instruments with accuracy of 30 arcsec may be found. 40 stones form the central ellipse with 45x36 m sizes, having a ruined stone-cluster in the centre. There is a 8m wide 8-stone road to N-E. Some stones were used to find the directions to definite stars.

By some estimations (observations of definite stars), the observatory was used during 7700-2200 B.C., for about 5500 years. According to many authors (ex. Bochkarev & Bochkarev 2005), a comparison of the present state of the monument with its situation a hundred years ago reveals a considerable degradation. Thus, the monument needs an urgent protection. The monument is unique of its kind at least in the Trans-Caucasian region and could be even the oldest known observatory in the world. If the estimated age of Karahunge is confirmed by archaeological methods, it clearly should be included in the UNESCO World Heritage list of the most important cultural memorials of our planet.

### ***Armenian Astronomical Rock art***

Studies of the Armenian rock art present in the territory of modern Armenia (historic Armenia was ten times larger, having 300,000 square km area) show that the Armenians were interested in heavenly bodies and phenomena. The Earth, the Sun, the Moon, planets, comets, Milky Way, stars, constellations are reflected in these pictures drawn on rocks in mountains around Lake Sevan and elsewhere in Armenia. These pictures and drawings are being studied by a number of historians, archaeologists, and astronomers. However, there is not enough governmental attitudes to organize large-scale studies or at least try to catalog and preserve these ancient treasures.



## **2.2. Research Institutions**

Among the modern institutions, those are considered as scientific tourism sites, where equipment or laboratories presenting attraction from the point of view of tourism are present. Among the astronomy and space science related ones are:

- NAS RA V. Ambartsumian Byurakan Astrophysical Observatory (BAO)
- Viktor Ambartsumian Astronomical Observatory of the Yerevan State University (YSU)
- Aragatz Cosmic Particles Station (belongs to Alikhanyan National Laboratory, Yerevan Physics Institute, YerPhI)
- Herouni Space Centre (not operational)

### ***NAS RA V. Ambartsumian Byurakan Astrophysical Observatory***

BAO is a historic-cultural high value and thus one of the most important places of Armenia and attracts tens of thousands of visitors every year, both from Armenia and from abroad. It is no coincidence that for many years the visit to the Observatory is included as a mandatory program in the list of Armenian schoolchildren tours and an offer to visit the Observatory is almost always on the list of travel agencies.

BAO was founded in 1946 and it is the only professional astronomical observatory in Armenia. It has unique architectural ensemble, rich botanical garden, as well as it is a visiting card to represent

Armenia. It is situated in Aragatzotn Province, on the Southern slope of Mt. Aragatz, near village Byurakan.

**Viktor Ambartsumian's house-museum** is located on the site of the Observatory, where he lived 46 years, in 1950-1996. It was established in 1998 and introduces visitors to the life and activities of the great scientist.



The visitors can see **the largest 2.6m telescope** and get an understanding on its operation, the **1m Schmidt telescope** is also possible to see during the longer visits, and have observations with a dedicated small 32cm telescope during the evening or night hours. One of the most important values at BAO is the famous and unique in the world **Markarian spectroscopic survey** and its digitized version, which has been included in the UNESCO's "*Memory of the World*" International Register of documentary heritage list. It is worth to mention that it is one of the 11 UNESCO heritage items from Armenia and is rather rare in these lists as a scientific value.

The Observatory has a Conference Hall, where many international and local symposia, conferences, workshops, seminars, summer schools for young astronomers and other events have been taken place. **Viktor Ambartsumian office** is being used for smaller events, which has been preserved in its original state and is being used for Scientific Council sittings, solemn meetings, seminars, lectures, etc. There are many possible subjects for **popular lectures** that BAO offers for its visitors, as well as **Astronomical films** are also performed accompanied by professional astronomers.

There is a hotel (Guest House) just in the territory of the Observatory for some 25-30 guests, built in the Armenian national architectural traditions by the famous architect Samvel Safaryan. The hotel has a kitchen and laundry. The Observatory also has a canteen, where the hotel habitants can take meals, as well as receptions, dinners and other events may be organized for up to 70 persons.

Several types of visits are being organized and Astronomical lectures are being given by professional astronomers. The full information is given at BAO Scientific Tourism webpage: <https://www.aras.am//SciTourism/eng>.

### ***Herouni Space Centre***

The famous telescope (ROT-54/2.6) is located a on Mount Aragats, at a height of 1,711 metres. The radio telescope has a diameter of 54m. It is hemispherical, and fixed to the ground, with a movable secondary mirror with a diameter of 5m. This provides a useful diameter of 32m. It has a surface accuracy around 70/100  $\mu\text{m}$ , giving an operating wavelength of 30-3mm (10-100GHz), and was originally designed to observe down to 1 mm (300 GHz). Construction took place between 1975 and 1985, first operating in 1986. It was not damaged by the 1988 Armenian earthquake, and was used for observations between 1987 and 1990. The optical telescope has a 2.6m mirror, with a 10m focal length. Telescope never operates from the date of its implementation.



### 2.3. Science-Related Museums

Among museums having relation to astronomy and space sciences are:

- Space Museum
- Matenadaran museum of ancient manuscripts (where a lot of manuscripts of astronomical nature are present)
- Viktor Ambartsumian house-museum in Byurakan

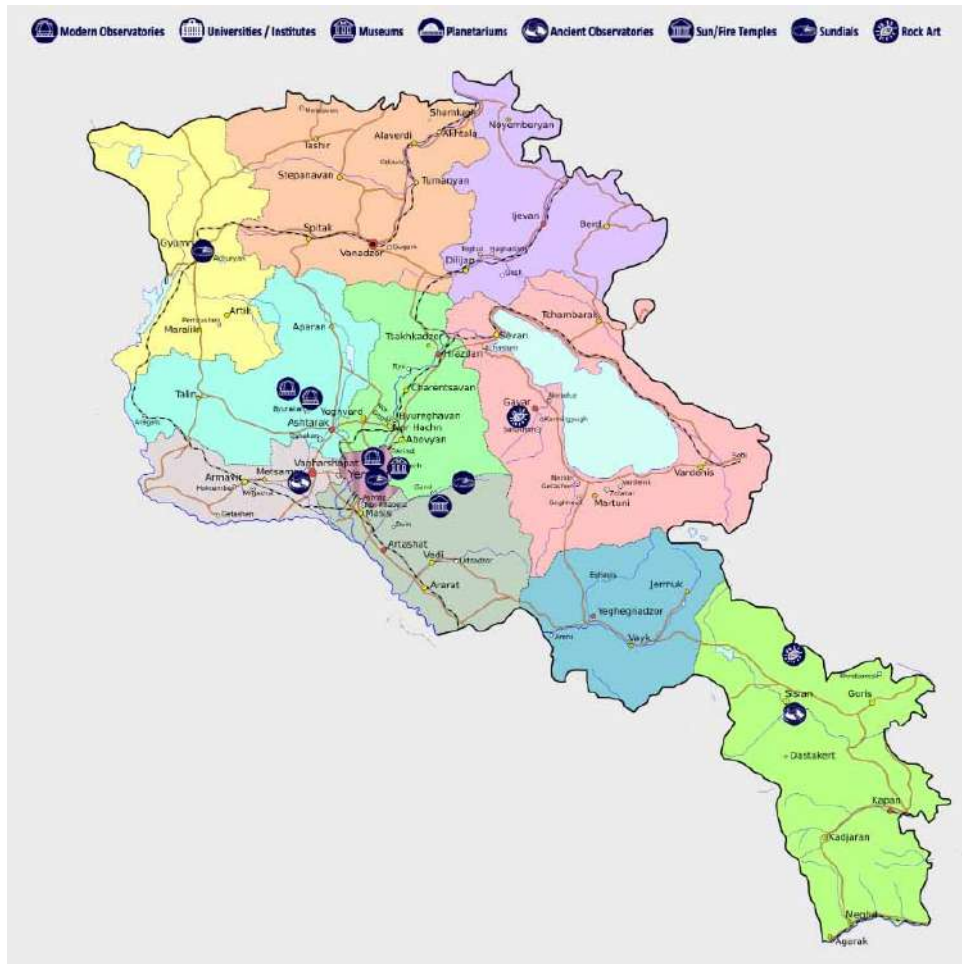
#### *Space Museum*

It was founded by Grigor Gurzadyan in 2001 in Garni, and in 2015 was moved to Yerevan. The museum exhibits early samples of space research, including landing equipment returned from the Cosmos, other spacecraft, a copy of the ORION-2 Observatory, which was exhibited in Hannover EXPO 2000. The museum collection includes documents, manuscripts authored by cosmonauts, Vostok, Soyuz space engineers, scientists, and from NASA. One of the most valuable examples is the manuscript of Nobel Prize laureate Hans Bethe, written jointly with Grigor Gurzadyan.



### 3. Armenian Astro Tourism Map

Armenia has a very rich Astronomical Tourism map, as mentioned above, many items of different types (ancient astronomical sites: rock art, ancient observatories, sundials; medieval universities, Byurakan Astrophysical Observatory, other modern institutions, the Space Museum, Viktor Ambartsumian house-museum) are present. We have created the Astro Tourism map of Armenia, which may serve as a reference for theoretical (study) and practical (implementation) Astro Tourism.



*The Armenian Astro Tourism Map. Mentioned items are (from top to bottom): Sundial on Holy Saviour Church in Gyumri, Herouni Space Centre, Byurakan Astrophysical Observatory (BAO), Rock Art in Geghama Mountains (Gegharkunik Province), Space Museum in Yerevan, Viktor Ambartsumian Observatory of the YSU, Sundial on Saint Gregory the Illuminator's Cathedral in Yerevan, Sundial on St. Stephen's Monastery of Goght (Geghard?), Garni Sun Temple, Metzamor Hill Astronomical Platform, Rock Art in Ughtasar (Syunik Province), and Zorats Karer (Karahunge) Ensemble (Syunik Province).*

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