

Development of the Science of Astronomy and Astronomical Education in Uzbekistan

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Abstract: The article is devoted to the development of astronomical science and astronomical education in higher educational institutions of Uzbekistan. Brief information about the Maidanak high-mountain observatory (Kashkadarya region), researches carried out at this observatory and instruments for observations are being described as well.

Keywords: astronomical education, astronomical science, Maidanak observatory (Uzbekistan), Astronomical Institute of the Academy of Sciences of the Republic of Uzbekistan, telescopes, researches.

The Astronomical Institute of the Academy of Sciences of the Republic of Uzbekistan was founded in 1966, earlier this building functioned as Tashkent Astronomical Observatory. Since the end of the 19th century, the Astronomical Institute has been included in the International Latitude Service.

There are 4 main scientific and research departments at the Astronomical Institute of the Academy of Sciences of the Republic of Uzbekistan: they are department of Solar-Terrestrial Physics, head of this department: Ilyasov S.P., department of Theoretical Astrophysics, head of this department: Akhmedov B.Zh; department of Applied Space Research, head of this department: Fazilova D. Sh.; department of the Maidanak Observatory, head of this department: Burkhonov O.A., director of the Astronomical Institute of the Academy of Sciences of the Republic of Uzbekistan, professor Sh.A. Egamberdiev.



Pic.1. Students at the Astronomical Institute of the Academy of Sciences of the Republic of Uzbekistan

The main priority areas of scientific research at the Astronomical Institute of the Academy of Sciences of the Republic of Uzbekistan are applied space research; astro climate research; solar research; observation and study of blazars, gravitationally lensing quasars and nearby galaxies; relativistic astrophysics of compact celestial objects; electrodynamics in curved space – time and others [1]. Students of various universities receive astronomical education in Uzbekistan the following fields: “Physics and Astronomy”, “Astronomy” and others, for example, at: National University of

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Uzbekistan, Tashkent State Pedagogical University named after Nizami, Kokand State Pedagogical Institute named after Mukimiy, Jizzakh State Pedagogical University named after Abdullah Kadiri, etc. To conduct astronomical observations of celestial objects the Astronomical Institute of the Academy of Sciences of the Republic of Uzbekistan has created educational observatories in the following cities and suburbs of Uzbekistan: Tashkent, Samarkand, Andijan, Karshi, Nukus, etc. [4].



Pic.2. Lecturer and students in the museum of the Astronomical Institute of the Academy of Sciences of the Republic of Uzbekistan

The Astronomical Institute of the Academy of Sciences of the Republic of Uzbekistan carries out cooperation and joint work with leading universities of Uzbekistan: conducting joint scientific research and observations of celestial objects, preparing final qualifying bachelor's and master's papers, joint publications of scientific articles, holding conferences, holding lectures for students who study "Physics and astronomy" in pedagogical universities of the Republic of Uzbekistan.

The Astronomical Institute of the Academy of Sciences of the Republic of Uzbekistan currently cooperates with the following foreign astronomical observatories, universities and centres such as SAI MSU, National Astronomical Observatory of Japan, Stanford and Pittsburgh Universities (USA), European Southern Observatory, Potsdam Centre for Earth Science, Consortium of Seoul Universities, Taiwan University, University of Nice, Astrotel JSC. Within the framework of this cooperation, the following work has been carried out: joint astronomical observations, scientific internships, advanced training of the institute's staff and scientific research in the leading astronomical centres of the world.

Cooperation is being carried out with the P.K. Sternberg State Astronomical Institute at Moscow State University named after M.V. Lomonosov and the Astrotel company (Russia) on the implementation of remote methods of astronomical observations [2].



Pic.3. Robot telescope at the Maidanak high-mountain observatory



Currently, researches carried out at the Astronomical Institute of the Academy of Sciences of the Republic of Uzbekistan are based on observational data obtained at the high-mountain observatory Maidanak, located on the western spurs of the Pamir-Alai mountain system at an altitude of 2650 meters above sea level. The Maidanak Observatory is unique in its astro-climatic conditions and geographical location; it is located in the middle between the main astronomical observatories in the Canaries and Hawaii [3].



Pic.4. the Maidanak Observatory (Kashkadarya region, Uzbekistan)

The high quality of atmospheric images of stars and the large amount of clear night time at the observatory make it possible to effectively implement many observational programs. This makes the Maidanak Observatory a very important point for continuous monitoring of celestial objects.

Location of the Maidanak High Mountain Observatory

Longitude = +66.8964 deg (66 53 47)

Latitude = +38.6733 deg (38 40 24)

Altitude = 2593 m above sea level

Host institution: Ulugh Beg Astronomical Institute (Tashkent, Uzbekistan)

The main instruments at the Maidanak high-mountain observatory: the main reflecting telescope - AZT-22 with a mirror diameter ($D = 1.5$ m) with a highly sensitive digital camera installed; Zeiss-600 ("Tashkent") ($D = 600$ mm, $F = 7200$ mm); ASTROTEL-Maidanak: Astrosib RC-500 telescope ($D = 508$ mm, $F = 4064$ mm), Apogee Alta U-16M CCD camera (4096×4096 pix, pixel = 9 microns); The EAST project ("Earthshine and Asteroseismology Telescope") is an installation for observing the ashen light of the Moon (small instrument). Robotic telescope of the Maksutov system "Questar" ($D = 90$ mm, $F = 2250$ mm) + CCD camera (1024×1024 pixels); Project DIMM ("Differential Image Motion Monitor", ESO) - astroclimatic monitoring of the FWHM of Mount Maidanak; Telescope Celestron-11 ($D = 280$ mm, $F = 2800$ mm).

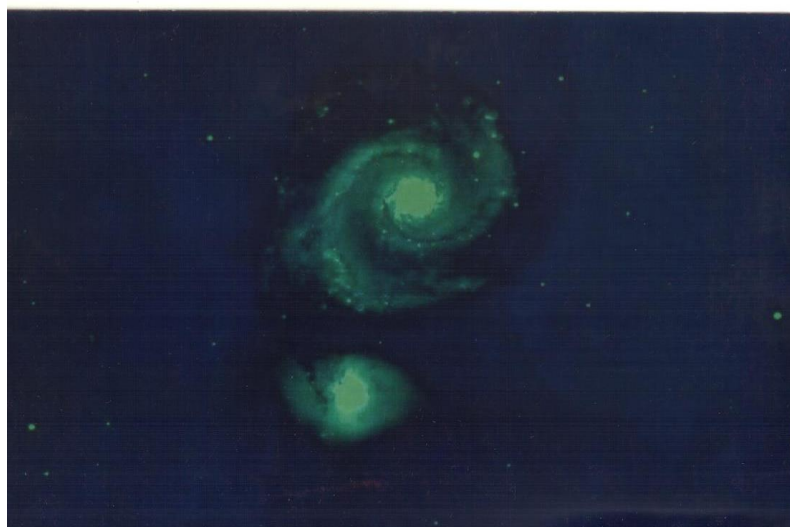




Pic.5. Reflecting telescope - AZT-22 with mirror diameter ($D = 1.5$ m)

Main observational programs: observation of artificial Earth satellites; observation of celestial objects of gravitational lensing; observation after the glow of gamma-ray bursts (30), photometry of variable stars and quasars and others.

The main discoveries and achievements achieved during the observation of celestial objects at the Maidanak high-mountain observatory: Observations on photometers of more than 100 variable stars made it possible to draw fundamental conclusions about the phenomenon of rotational modulation of T Tauri stars; the first asteroid on the territory of Uzbekistan was discovered in autumn 2007 in Samarkand, it was officially included in the International Catalogue of Minor Planets under the number 210271 and the discovery of asteroid 22948, named - Maidanak [5]; in the first series of asteroid discoveries, 79 previously unknown asteroids were discovered in 5 hours and 30 minutes of observations; discovered a supernova in the spiral galaxy NGC 3938 in the constellation Ursa Major – the supernova, numbered SN 2017ein, was discovered as part of a program for monitoring nearby galaxies; the first astrovideo in the CIS was filmed in Maidanak; the ability to observe with a resolution of 0.3" and celestial objects up to magnitude 23; the observatory's meter telescope was the main equipment for astronomical observations in the 1970s, it was developed by the German company "Carl Zeiss".



Pic.6. A photograph of 2 galaxies obtained with the AZT-22 telescope

After modernization, the 17-ton telescope became a modern high-precision telescope with an automated control system, reaching the high level of similar devices.



China has built a solar power plant at the Maidanak Observatory to continuously recharge a telescope designed for astronomical observations.

Astro tourism is developed in Uzbekistan, and the Maidanak Observatory is one the main sightseeing of our country.

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