PREFACE

In 2019 the 60th anniversary of the Shamakhy Astrophysical Observatory named after N.Tusi of the Azerbaijan National Academy of Sciences (ShAO) was celebrated. In this regard,the submitted this number of the Azerbaijan Astronomical Journal (AAJ) is dedicated to the 60th anniversary of the ShAO. Brief information on the history of the observatory, its main scientific-research directions, and significant achievements over 60 years, scientific and organizational activities, scientific relations, international grant projects in recent years, human resources are the main topics of the publication. It should be noted that the Observatory, established in the Soviet period, was developed rapidly in accordance with the requirements of that time. Star and solar telescopes with a diameter of 60 cm, 70 cm, and 2-meter, which were very relevant at that time, enabled to study modern problems of astrophysics. At the beginning of the space age, the measurement of sunspots, flares, and other parameters of solar activity and the using of this information for Earth's satellites safety forecas was important step in the early stages of formation of specialists at the observatory and its future development. The favorable geographical position of the observatory, its astroclimate, the large number of clear nights, and the supply of equipment were led to the rapid development of its international relations and the formation of future astrophysical schools. Although the priority scientific research directions was naturally changed over the years, they have covered a very wide range as a whole. The main research fields were solar physics, physics of solar-terrestrial relations, planetary physics, dynamics of small solar system bodies, different types of stars and stellar systems physics, galaxies, problems of cosmology, radio-astronomy, astronomical instrumentation et al. Important scientific results obtained in different periods have not lost their relevance today too. Here we will present some of them.

In the field of solar physics. Studies on solar physics at the ShAO dates back to 1957. In the same year, the Solar Service program was established at the Observatory, and regular observations at the Chromosphere-Photosphere Telescope played a key role in this work (R.Huseynov). The results of these observations are included in a number of international catalogs. In the following years, important results were obtained in both theoretical and practical research on problems of solar physics. The theoretical model of solar flares was developed, and the idea that this important event is associated with shock waves was put forward (R.Huseynov). The rising curve of solar spectra is constructed.It was shown that the asymmetry in the profiles of the weak and middle Fraunhofer lines of the photosphere is complex. In the same line this parameter varies very frequently both quantitatively and sign. The mechanisms by which the solar corona heating up to a million degrees were studied, including the role of solar spicules in this process. The MHD theory of Rossbi-type eigen global vortex oscillations of the Sun was developed (N. Dzhalilov). The devoloped theoretical model aims to solve two important problems: a) Depending on the configuration and intensity of the central relic magnetic field, the considered waves can create the necessary level of "dencity noise" in the plasma around the solar core, which in turn causes the oscillation of the active solar neutrinos from the nucleus (MSW mechanism). Measured data and theoretical results of solar neutrino deficiency could be used to diagnose physical conditions in the central regions of the Sun; b) Vortices in the central region of the Sun affect the rate of nuclear fusion. Also, vortices moving towards the surface can change the optical properties of the photosphere. Such effects cause the integral radiation energy of the Sun to change quasi-periodically. These changes could lead to global climate change on Earth. For example, the sharp warming that lasted for several thousand years during the last ice age, as well as the current global warming, have no clear explanation. Important results were obtained in the physical origin of large-scale turbulence in the solar wind, its impact on the earth's

ecosystems and biosystems, and in a number of other relevant areas of Solar-Earth physics (N.Dzhalilov, E.Babayev).

In the field of planetary physics. Under the leadership of N.Ibrahimov, a number of optical parameters of the planet's atmosphere were determined by measuring the variations in the brightness of the entire disk of Mars. In order to study the chemical composition of the atmosphere of Mars, its highly dispersed spectra were obtained, and more than two thousand photographs of the planet were taken in various filters. The results of all these observations show that the brightness of the details on the planet's surface is constantly changing, and that dust particles are forming and disappearing in its atmosphere. It was shown that the molecule of nitric oxide in the atmosphere of Mars is insignificantly small. These results were completely consistent with the results of the subsequent Viking 1 and Viking 2 NASA space missions. Research on Mars has played an important role in the construction of topographic maps of the planet, the study of the problem of transparency of its atmosphere and other problems related to the evolution of the planet. N.Ibrahimov took the spectrum of the dark side of the planet Venus and discovered radiation lines. He explained the formation of these lines of radiation by the presence of lightning in the planet's atmosphere. Later, the Soviet interplanetary spacecraft "Venus" confirmed this fact. He was also one of the first to predict the occurrence of active (volcanic) processes on Jupiter's satellite Io on the basis of observational materials. This conclusion was confirmed in 1979 by the results of the interplanetary spacecraft Voyager 2, which passed close to Jupiter. Currently, research is underway in the field of giant planetary physics, and important results were obtained in this area (A.Atai).

In the field of research of small bodies of the solar system. Pioneer works belong to Hajibey Sultanov. As early as the 1950s, he studied the distribution of invariant elements of asteroids statistically and refuted Olbers theory that they formed as a result of the disintegration of an object. He argued that the ring of asteroids was formed as a result of the successive disintegration of several relatively large primordial objects moving between Mars and Jupiter. Interesting results were obtained in the direction of the chemical composition of asteroids (D.Shestopalov) and the origin of comets (A.Guliyev).

In the field of stellar physics. In 1960-80, theoretical research had a special place in the scientific topics of the ShAO. Pioneer research in this area belongs to O.Huseynov and his group. The Moscow school and its bright representatives O.Zeldovich and G.Bisnovati-Kogan played a important role in the development of theorists working in Azerbaijan. Theoretical research has focused on the physical nature of the end products of stellar evolution. It was proved that as a result of catastrophic compression of stars, neutrinos and antineutrinos with an energy of 50 MeV are formed. The formation of a neutron star in the center of a collapsed star leads to an increase in the total energy of the neutrino and at the same time a softer spectrum. The results of these studies were used at the Baksan Neutrino Observatory. Within the relativistic theory, the parameters of a rotating neutron star were calculated. It was shown that even stars with very large masses undergo a pre-collapse stage at the beginning of their evolution. At the same time, it is proved that the type I and II flares in the Supernovas differ both in terms of energy and mass. For the first time, a catalog of the richest X-ray sources (about 700 objects) was prepared and published in the United States. In addition, for the first time, a method for determining the electron concentration in 331 pulsars in the galaxy was given. Based on it, the distance to the pulsars and a number of its parameters were determined. It was shown that pulsars are located in a ring near the center of the galaxy. The thickness of this ring is 8 Kps. For the first time, a new scale of distance to Planetary nebulae was determined for radiation. The vast majority of scientific results were confirmed in space experiments.

Research in the field of practical astrophysics is aimed to study the non-stationary processes occurring in various stellar atmospheres, stellar systems, and galaxies by using

spectrophotometric methods and modern light receivers made at the ShAO (Kh.Mikayilov). It is shown that the internal structures of the stars in the upper and lower parts of the main sequence are different (T.Eminzade). It is proven that, unlike red dwarf stars, white dwarf stars have a nucleus. Later this result was confirmed by research of world-renowned astronomers. Among the studies carried out in the ShAO and currently underway, dense binary stars (S.Azimov, B.Rustamov, J.Rustamov), T Taurus-type stars (Z.Ismayilov, N.Ismayilov), magnetic stars (S.Aliyev) , important results were obtained in such areas as physics of active nuclear galaxies (N.Huseynov, I.Salmanov), determination of chemical composition of stars (S.Zeynalov).

In the field of history of astronomy. The scientific heritage of the medieval Azerbaijani scientist Nasreddin Tusi was studied (H. Mammadbeyli). Dozens of Tusi's works were studied, commented on and discussed by the scientific community. Numerous articles, books and monographs dedicated to the life and work of the scientist were published, presented at conferences and symposiums. The book "Tahriri-Oglidis", which is considered to be the largest work of N.Tusi, was translated into Azerbaijani. H.Mammadbeyli studied N.Tusi's works and at the same time revealed interesting facts about the equipment, library, structure, scientific directions, achievements and staff of the Maragha observatory created by him, proved that this scientific center has an important place in the world scientific history.

ShAO has risen twice in its history. At the beginning of the independence of the Republic of Azerbaijan after the Soviet era, there was a period of stagnation in the life of the observatory. Over the last ten years, as a result of the care of the leadership of the Republic of Azerbaijan for astronomy, the Observatory was rebuilt, modernized, serious changes were made in the instrument park, and as a result, development has resumed at a high pace. At present, it is possible to carry out spectrophotometric studies of weak celestial bodies (stars up to -18) with the help of modern light receivers with very high transmittance installed in a 2 m telescope. All of this and the availability of high-speed Internet, as well as the modern level of infrastructure make ShAO attractive for international projects. ShAO participation in EU projects FP7, HORIZON 2020, GRANDMA, GAIA, etc. can be an example of this.

This issue provides a brief overview of a number of selected topics to give the reader a better idea of ShAO, about the research that is done and is currently carried out in ShAO, the important scientific findings and publications on these topics. More information could be found in the publications at the end of each review. At the end of the issue, some space was allocated for scientific and organizational events. In providing all the information, the data of recent years were given more priority.

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SHAMAKHY ASTROPHYSICAL OBSERVATORY – THE MAIN HISTORICAL MOMENTS

The 20th century was a period of dramatic and memorable events in the life of the Azerbaijani people. At the beginning of the century, this region, well-known in the world only for the extraction of petroleum, consequently became a region where culture, science, and technology developed rapidly. At this period, our people had given scores of eminent poets, writers, scientists, artists, singers to world culture, and in turn, tried to derive benefit on world culture. Azerbaijan held a special place in the former Soviet Union, where fundamental science reached a high level of development, and its educational and scientific institutions differed by high professional level and rating.

As is well known, Azerbaijan is considered the country of ancient astronomers. Famous petroglyphs of Gobustan and Gamigaya, also archaeological sites and excavations are clear proof of this truth. The scientific achievements of the Maragha Observatory and its founder Nasiraddin Tusi played a significant role in the development of world astronomy. Interest in the universe and astronomy had always been the focus of attention on this land.

In the 20th century, astronomy was received large-scale scope in Azerbaijan, like other branches of science. Creation of the Shamakhy Astrophysical Observatory, its high-altitude observation stations, space research institutes, the preparation of dozens of highly qualified researchers in the field of astronomy, in a literal sense, the formation of the national astronomical school, coincide with this period.

Astronomy held an important place along with all the natural sciences, which were studied and taught in secondary and high schools and other educational institutions, created at the beginning of the century in Azerbaijan. Azerbaijani youth studying natural sciences in other countries chose astronomy and geography often as their main specialties and studied these sciences in depth. Besides, due to the absence of an astronomical institution or observatory in Azerbaijan, such young people, like other amateur astronomers, could not seriously study this science, and therefore a professional school of astronomy not formed.

The issue of creating an astronomical observatory in Azerbaijan was raised in 1927. In the same year, a short-term expedition of the Leningrad Astronomical Institute (A.V. Markov and V. B. Nikonov) had visited Azerbaijan and got acquainted with the climate and relief of several zones with the participation of local expert I.A. Benashvili. The goal of the expedition was to choose a suitable place to create an observatory in Azerbaijan. This expedition got acquainted with the astroclimate of Khankendi, Shusha, and Lachin in July-August 1930. Although the conditions in the Lachin district were favorable, it was discovered that the number of clear nights was not enough. Research results of the expedition were published in 1932 in the bulletin of the Institute of Astronomy in Moscow.

Regrettably, destructive processes of the 1930s delayed this process. However, with the return of the graduate of Leningrad State University H. Mammadbeyli to his homeland in 1938, significant progress in the field of astronomy was begun. In 1939-1946, the teaching of astronomy began at Azerbaijan State University and other higher educational institutions. The astronomical laboratory was founded at Azerbaijan State University, and the area for observations was allocated.

Besides that, astronomical calendars were publishing at the university. Radio and television programs also have played a significant role in popularizing astronomy. The shaping of eminent astronomers T. Eminzade, H. Sultanov, R. Huseynov as qualified specialists coincided with these years. In the postwar period, again was raised the question of choosing a place for the construction of the observatory, and organized the expedition in several regions of the country. Astronomers from Leningrad and Moscow also took part in this work. The standing astronomical expedition was created in 1946 to study the astroclimate in several regions of Azerbaijan. As a result of researches carried out in 1953-59, along with astronomical observations, serious work was carried out on preparing staff in the field of astronomy, on designing future observatory, on supplying the observatory with telescopes and equipment, the structure of the observatory, etc.