

Prof. Lyudwik Mirzoyan's life and activity

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Abstract

Prof. Lyudwik Mirzoyan is one of the best representatives of the first generation of Armenian astronomers who had founded Byurakan Observatory and the Byurakan direction in science. For thirty years he had been the assistant of Victor Hambartsumian at Byurakan Observatory and has a huge input in formulation of the modern understanding of star formation, thus becoming the pioneer in Armenian observational astronomy.

1. Introduction

A XV joint Armenian – Georgian astronomical colloquium dedicated to the 100th anniversary of Academician Lyudwik Mirzoyan, took place in Byurakan Astrophysical Observatory of the National Academy of Sciences of Armenia. The tradition of Armenian – Georgian joint scientific meetings had been established back in the 1970s, and by the initiative of Academician Victor Hambartsumian. Both Victor Hambartsumian and Lyudwik Mirzoyan have played a great role in the development of astronomy in Georgia and, due to their efforts, several joint Armenian – Georgian scientific programs had been implemented. They have educated several generations of Georgian astronomers, guiding their scientific research works. To note, this year in May—and on the occasion of the 90th anniversary of prominent astrophysicist, Academician of the National Academy of Sciences of Armenia, First Armenian Member of the French International Academy of Astronautics, Professor, Honored Scientist of the Armenian Soviet Republic Lyudwik Mirzoyan—the presentation of the book entitled *Life Devoted to Byurakan*, written by his daughter Nune Mirzoyan, took place at the hall of the Presidium of the National Academy of Sciences of Armenia.

Lyudwik Mirzoyan is one of the best representatives of the first generation of Armenian astronomers who had founded Byurakan Observatory and the Byurakan direction in science. For thirty years he had been the assistant of Victor Hambartsumian at Byurakan Observatory and has a huge input in formulation of the modern understanding of star formation, thus becoming the pioneer in Armenian observational astronomy.

2. Biography

Lyudwik Vasili Mirzoyan (1923-1999) was born on May 1, 1923, in Yerevan. His parents were from the city of Maku in the Atrpatakan region of Iran and had strong ties with prominent Armenian cultural figures. Specifically, L.V. Mirzoyan's father, Margar Mirzoyan, was the brother of Yeghishe Charents' mother, Tekghi Mirzoyan (Telli Mirzayan). His mother, Anush Avdalbegian, was the sister of the renowned Armenian scholar Tadevos Avdalbegian.

Despite losing his father at a young age and facing various economic and psychological challenges, L.V. Mirzoyan managed to get admitted and graduate from the Faculty of Physics and Mathematics of Yerevan State University, obtaining a degree in mathematics. In 1947, he received a recommendation from the academician Victor Ambartsumian to work at the newly established Byurakan Observatory. His pedagogical activities also commenced during this time.

In 1951, under the joint supervision of Ambartsumian and Oleg Melnikov, Mirzoyan successfully defended his dissertation, which focused on the spectrophotometric study of stars belonging to early spectral classes.

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This achievement earned him the degree of Candidate of Physico-Mathematical Sciences. In 1953, Mirzoyan assumed the role of scientific secretary at the Byurakan Observatory, and in 1959, he became the deputy director—a position he held for approximately three decades.

During this time, the Byurakan Observatory has received international recognition and has become one of the leading observatories in the world, having received the honorary Order of Lenin, the highest state award of the USSR. Since 1965, Mirzoyan headed the Department of Physics of Stars and Nebulae at the Byurakan Observatory.

Since this same year, Mirzoyan was actively involved in the works of the newly founded Soviet Union's journal "Astrophysics". Initially, he served as deputy of editor-in-chief and later as editor-in-chief. Despite the challenging circumstances faced by the country in the 1990s, Mirzoyan's dedicated efforts ensured the continued publication of the journal. In addition to his editorial responsibilities, Mirzoyan served as a member of the scientific publishing board of the Armenian Soviet Encyclopedia, and he authored a majority of the astronomical articles within its pages. His editorial and scientific publishing activities extended beyond these roles, as he authored or edited numerous monographs, international conference materials, symposiums, popular science books, textbooks, and more than 200 articles. Notably, his monographs highlighted the achievements of the Byurakan school of astronomy and underscored the contributions and impact of its founder - V.A. Ambartsumian, in modern astrophysics.

In 1968, Mirzoyan successfully defended his doctoral dissertation in Leningrad, focusing on the physics and kinematics of young stars. This accomplishment led to his recognition as a Doctor of Sciences. Mirzoyan's significant contributions and stature in the field of astronomy were acknowledged through his election as a corresponding member of the International Academy of Astronomy in 1970, a corresponding member of the Academy of Sciences of the Armenian SSR in 1986, and an academician of the National Academy of Sciences in 1996. Furthermore, in 1974, he was bestowed with the honorary title of Honored Scientist of the Armenian SSR. Mirzoyan's scientific, scientific-organizational, pedagogical, and editorial endeavors consistently garnered high praise from Soviet-Union, domestic, and international institutions.

3. Scientific activity

The beginning of L.V. Mirzoyan's scientific activity coincided with two significant, fortunate events for the development of modern astrophysics. The first was the foundation of the Byurakan observatory, and the second was the discovery of stellar associations by V.A. Ambartsumian. The discovery of stellar associations provided a unique opportunity to establish and study early stages of star evolution, making the Byurakan observatory a leading center for such research.



Figure 1. V. Ambartsumian and L. Mirzoyan

L.V. Mirzoyan's early (1950-1970) scientific works focused primarily on the study of stellar associations and their stellar populations, particularly in relation to hot OB stars of the early class. Some of the key

contributions and findings from Mirzoyan's research include:

- 1) Determination of Interstellar Selective Absorption: Mirzoyan proposed a novel method for determining interstellar selective absorption based on the relationship he established between spectrophotometric gradients and color excesses of OB stars. He demonstrated that the average cosmic absorption law remains consistent in layers parallel to the galactic plane at varying distances.
- 2) Study of OB-Stellar associations: Mirzoyan introduced the concept of a "synthetic" stellar association stellar association, which involves combining all known stellar association stellar associations and subgroups of OB stars brought to a common center. He analyzed the spatial distribution law and partial density of O-B1 stars around the core of the stellar association stellar association, using data from 27 stellar association stellar associations and 744 O-B1 stars.
- 3) Determination of Solar Velocity and Oort's Constant: Mirzoyan utilized available data on the linear velocities of 330 OB stars to determine the velocity speed of the Sun and Oort's constant A, which characterizes the rotation of the Galaxy. His calculated value for constant A was significantly smaller than the previously accepted value and was subsequently adopted by the International Astronomical Union.
- 4) Investigation of the K Effect: Mirzoyan extensively studied the K effect in subsystems of O-B0.5 stars. He demonstrated that the K term, initially positive for nearby stars, gradually decreases and becomes negative with increasing distance from the Sun. Mirzoyan attributed this behavior to the dynamic origin of the effect.
- 5) Expansion of OB Stellar associations: Mirzoyan confirmed the expansion of OB stellar associations using radial velocities, building upon the predictions made by V.A. Ambartsumian and the works of Blaauw et al., which were based on proper motion studies. Mirzoyan's "synthetic" stellar association method enabled him to establish the expansion using radial velocities alone. He also observed that the mean and variation of radial velocities increase with distance from the interstellar core, suggesting that OB stars in the galactic field were ejected from parent associations.
- 6) Study of Formation and Development of OB Stars: Mirzoyan employed the "synthetic" stellar association method to investigate the rates of formation and development of OB stars. By analyzing available data, he deduced that the continuous decrease in star density from the center of the stellar association results from ongoing star formation. Mirzoyan estimated the average lifetimes of OB stars by interpreting the deviation from the inverse square law as an indication of the statistical aging process.
- 7) Analysis of Continuous Emission in Unstable Stars: Mirzoyan conducted studies on the continuous emission observed in the spectra of certain unstable stars. He concluded that known mechanisms of continuous emission were insufficient to explain the observed spectral features. Mirzoyan proposed that the observed continuous emission is non-thermal in nature, resulting from the direct quenching of intrastellar energy in the outer layers of stellar atmospheres.

Beginning in the 1970s, Mirzoyan's scientific work focused mainly on the study of red dwarfs, especially flare stars. The method proposed by V.A. Ambartsumian in 1968 to estimate the total number of flare stars inspired to more intense study of flare stars. L.V. Mirzoyan emerged as the in-fact leader of these studies conducted within the framework of an international program. Under his direct guidance and participation, astronomers from Armenia, Georgia, Uzbekistan, Kazakhstan, Bulgaria, and Hungary successfully conducted a comprehensive investigation of flaring star systems such as Orion, Pleiades, Hyades, Praesepe, and others, as well as flare stars in vicinity to the Sun. The main results of these studies were:

- 1) First and foremost, several hundred new flaring stars in neighboring stellar associations and star clusters were revealed. The studies of the physical characteristics of these stars (spectra, brightnesses, colors, etc.) were performed in both quiescent and flaring states.
- 2) The study of flare stars of the Sun's vicinity showed that these stars do not form a physical system, but are flare stars that appeared in the galactic field because of the disintegration of stellar associations and star clusters. The research also revealed a lack of relatively high-luminosity flare stars in the galactic field. Moreover, the flare stars majority discovered at the direction of a given stellar association or star

cluster (90%) are members of the association/cluster, confirming that the flaring activity of a dwarf star can be considered a reliable indicator of its association with a specific star cluster or association.

- 3) Stars in the galactic field do not qualitatively differ from stars in stellar associations and star clusters. Simultaneous observations of star flares provided evidence that the colours of flare radiation are broadly consistent between relatively high-luminosity flare stars of associations and clusters, as well as low-luminosity flare stars of the Sun's vicinity.
- 4) Some of the observed quantitative differences have been successfully explained by age differences in flare star systems. Evidence for this is the relationship between the age of the flaring star system and the average luminosity of the flaring stars established by Mirzoyan and his colleagues. The study of flare stars confirms Ambartsumian's hypothesis that the stage of flare activity is a regular stage in the evolution of red dwarfs.
- 5) In the 1970s -90s, in his articles and monographs Mirzoyan presented and supported the sequence of evolution of red dwarfs, suggested by Ambartsumian and Haro: from a protostar to a T Tau type star, a flare star, and, ultimately, to a normal star. During the 1970s, the spectrophotometric examination of unique objects exhibiting extraordinary spectral and photometric behaviors (V1057 Cyg, FG Sge, RW Aur, SS Cyg) continued under the guidance of renowned French astronomers Chalonge and Divan. This research also included a study of the ultraviolet spectrum of the P Cyg star, using by data of the "Copernicus" astronomical satellite (co-authors: Ambartsumian, Snow).

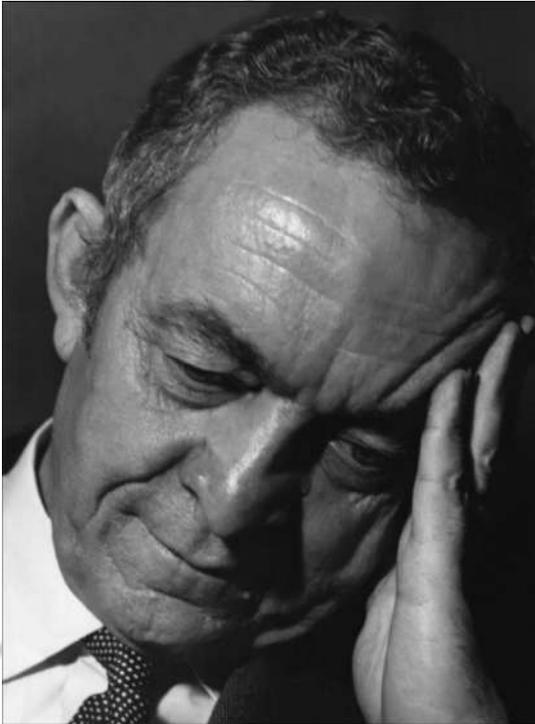
In addition to his work on stellar associations and young unstable stars, Mirzoyan's scientific research extended to various other subjects, including comets, quasars, and galaxy clusters. Notably, his studies on compact groups of galaxies conducted by Shahbazyan in collaboration with renowned astronomers such as Ambartsumian, Arp, and Osterbrock, deserve mention. Mirzoyan's scientific contributions in all above mentioned areas, along with his numerous articles of a general nature, played a significant role in shaping the scientific outlook of the new generation of astronomers.

The 1980s and 1990s were the peak of Mirzoyan's scientific effectiveness. In this period, research continued in all the above areas, along with the generalization and interpretation of a huge amount of observational data. The use of data from modern (at that time) astronomical satellites such as *ROSAT* and *HIPPARCOS* played a significant role in these achievements.

Mirzoyan's scientific style is characterized by clarity, rigor, lack of exaggerated claims and the desire to impress. His approach is distinguished by clarity and a commitment to accurate and reasonable presentation of scientific results. The influence of Mirzoyan's works on the formation of the scientific worldview of a new generation of astronomers cannot be overestimated.

Ludvik Vasili Mirzoyan stands as one of the most notable representatives of the first brilliant generation of Armenian astronomers, who laid the foundation for the Byurakan observatory. His contributions to both national and world astronomy are enduring and indelible.

4. Instead of an Epilogue



- Strict and Hardworking
- Upright and Impeccable
- Rigorous, Attentive and Instructive supervisor
- Unreserved devotee