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Editorial

ComBAO board *

NAS RA V. Ambartsumian Byurakan Astrophysical Observatory (BAO)

Modern astronomy in Armenia began exactly 75 years ago, in 1946, when the Byurakan Astrophysical Observatory (BAO) was founded. The founder of the observatory was Viktor Ambartsumian (1908-1996), who at that time was already a world-renowned scientist and the author of many very famous works devoted to the study of various problems of astrophysics, theoretical physics, nuclear physics, mathematics. He became the first director of the observatory, and, naturally, his scientific experience and physical intuition played the main role in predetermining the directions for further scientific research of the new research center. In 1946, the design of the observatory complex began, and then construction. Famous architect Samvel Safaryan was the chief architect of the first stage of the observatory complex. In fact, he designed all the first buildings and telescope towers.

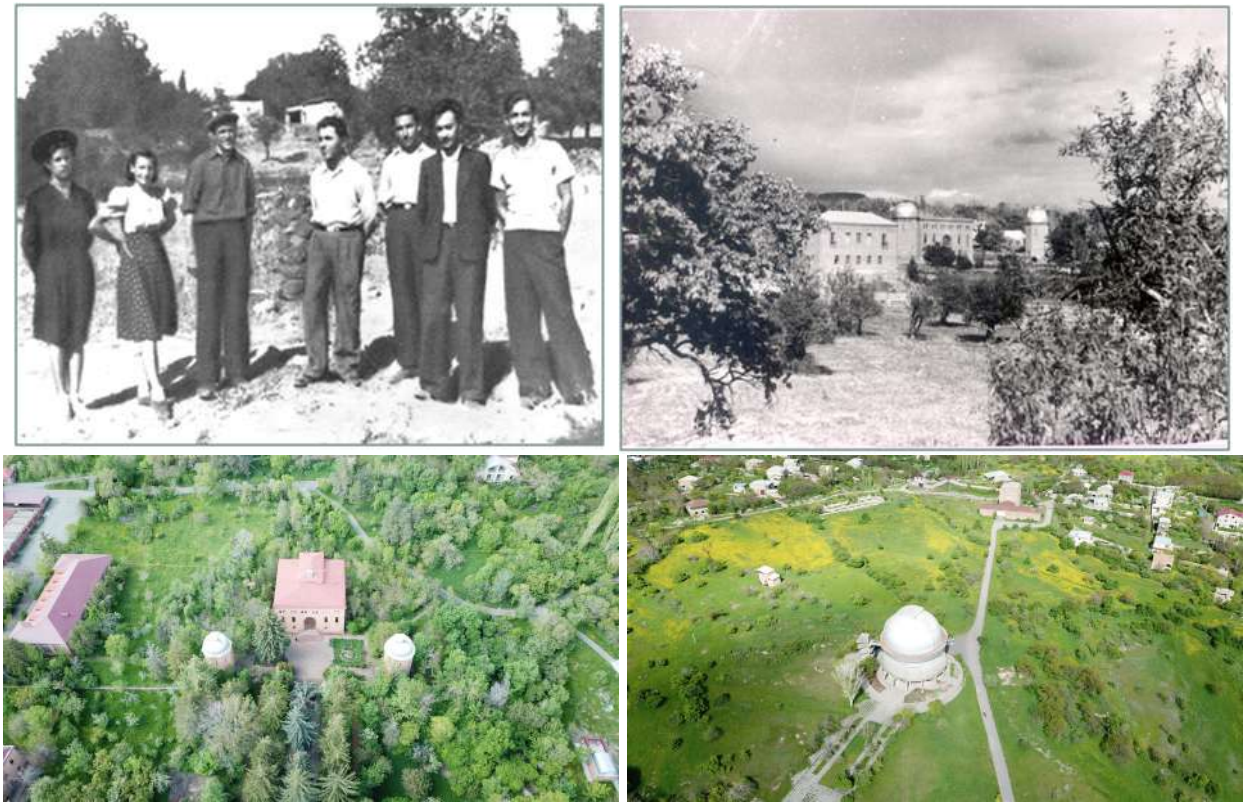

Figure 1. *Up left panel*: The Byurakan observatory here will be, 1946; *up right panel*: view of observatory in 1950s; *down panels*: view of observatory at present.

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From the very beginning of the observatory's activities, the main target of astrophysical research has become non-stationary phenomena in cosmic objects and their systems. This was due to the fact that only non-stationary phenomena could prompt the correct path of evolution of cosmic structures in short-period observations. Completely new scientific results came immediately after the founding of the Byurakan Observatory. In 1947, Ambartsumian drew attention to some groupings of hot stars, the probability of accidental merging of which is practically zero. He called these new type systems stellar associations. The analysis of the dynamics of these systems showed that both the associations themselves and the stars

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included in these systems should be much younger than our Galaxy. Thus, it was shown for the first time that star formation processes are currently taking place in the Universe. The second important conclusion was that the formation of stars is not an individual process but it takes place in groups from much denser, so called, super-dense matter. Moreover, another essential conclusion made on the base of that research was one asserting that existing gas and dust are results of the same cosmogonic process.

Figure 2. Byurakan in winter.

The approach to problems of a cosmogonic nature, which was tested for the study of stellar associations, became the basis of the methodology for further research in Byurakan. The main thing in this methodology was the unbiased application of the entire arsenal of modern science for the analysis of observational data.It is this approach, using the methods of statistical mechanics, the dynamic features of the structures under consideration, that provided fairly reliable interpretations and predictions in the evolutionary chain. This applies to objects of all hierarchical levels of the Universe, from atomic nuclei and elementary particles to galaxies and galaxy clusters. All these structures show some physical properties that should become cornerstone if the main determinants of their evolutionary paths are considered. Thanks to the selected scientific topics, the methodology for conducting scientific research and the effective use of in fact not very large telescopes, the Byurakan observatory very quickly became widely known throughout the world.

The study of the dynamic properties of stellar associations and unexpected conclusions for the scientific community about the process of star formation had far-reaching consequences both for this area of scientific research and for the worldwide presentation of the Byurakan Observatory. Therefore, it is not surprising that many researchers began to visit the BAO, and in November 1951, the first international conference was held here. The conference was devoted to the stellar associations recently discovered in Byurakan and the spatial distribution of hot giants that make up the population of OB associations. Since then, about 90 symposia and conferences have been held in Byurakan, including symposia of the International Astronomical Union, as well as the congress of the European Astronomical Society.

The next area of research, begun at the BAO in the tradition of studying stellar associations, was a radical revision of the cosmogonic significance of galactic nuclei.This work began in the mid-1950s with determination of the relative number of multiple galaxies in clusters, which turned out to be excessively large compared to the estimate made for the equilibrium distribution. A detailed analysis based on the laws of physics, statistics and observational data again led to the conclusion that in many cases we are witnessing the decay of galactic nuclei, the ejection of huge masses from nuclei, etc. In other words, at the hierarchical

level of galaxies, as in the case of young stars, the formation of galaxies occurs due to the decay of the denser matter of the core. This is how the term Active Galactic Nucleus (AGN) came into use for the first time. The results of the studies of this period were presented at the symposium of the International Astronomical Union IAU 29 "Non-stable phenomena in galaxies", which was organized in 1966 in Byurakan. All the most famous scientists working in this field attended this symposium.

Figure 3. IAU 29, 1966, Byurakan observatory.

At about the same time, on the initiative of Viktor Ambartsumian in Byurakan, Beniamin Markarian began a large observational project with the 1 m Schmidt telescope - a spectral sky survey, in order to search for galaxies with an ultraviolet excess in the spectrum. This project turned out to be one of the most successful observational campaigns, the result of which was the discovery of about 1500 galaxies, which today are known as the Markarian galaxies and are still being intensively studied all over the world. Today this survey (First Byurakan Survey, FBS) is included in the UNESCO documentary heritage "Memory of the World" and is one of the few scientific achievements included in the UNESCO heritage list.In addition to photographic plates, this survey is already available in digital form, carried out in international cooperation.

Both the discovery of newborn stars and the reassessment of the significance of galactic nuclei and the introduction of the concept of "Active galactic nuclei" undoubtedly made the Byurakan observatory famous. However, these are not the only innovations introduced into science by the Byurakan Observatory. A similar megaproject turned out to be the study of flare stars and the ultimate determination of the flare activity role in the evolutionary chain of non-stationary stars. The international observational campaign organized by the BAO made possible to prove that the flare activity of stars is a regular stage in the life of young stars. In the BAO and other observatories, many hundreds of flare stars have been revealed in star clusters and in the vicinity of the Sun during 70s and 80s. Unlike the 60s and 70s at present, there is no any doubt that this phenomenon is extremely common in the various types of stars.

In parallel with the major observational projects, from the very beginning, many works on theoretical astrophysics, as well as on the interpretation of observational data, were carried out at the BAO. Especially many articles have been published on the theory of radiation transfer. Many results have been obtained in the field of solving problems in the theory of radiation transfer under general laws of energy redistribution. Nonlinear problems, problems of non-stationary scattering, etc. are also considered. Moreover, unlike other scientific schools, in the BAO these problems were considered and are considered not by the method of

the classical transfer equation, but using the Ambartsumian Invariance Principle, which turned out to be a rather powerfull tool for solving problems in this area. In 1981. in Byurakan an international symposium "The principle of invariance and its applications" was organized by J.-C. Pecker.

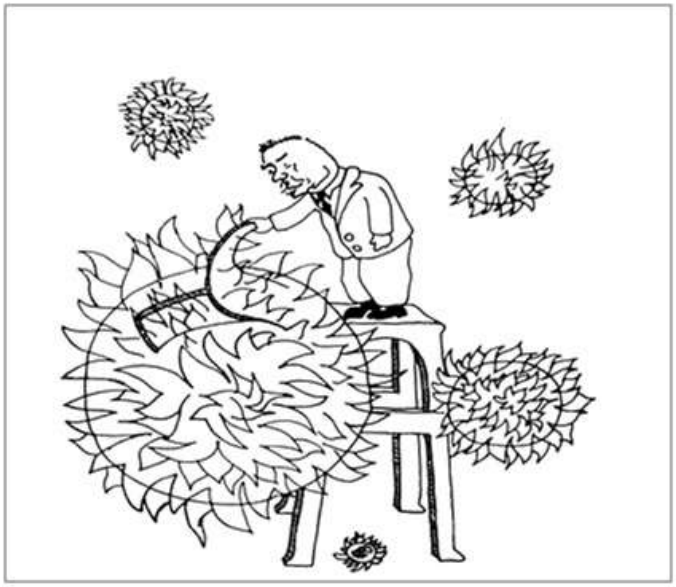

Figure 4. "The principle of invariance". Interpretation of by J.-C. Pecker.

Despite the fact that the Byurakan Observatory was created as a center for astrophysical research, very important conferences and symposia were held here that had no direct relation to astrophysics, like the research areas listed above. Such ones were the conferences, for example, devoted to the problems of communication with extraterrestrial civilizations. The first such conference was organized back in 1964. The second one had a completely different status. It was a first-class Soviet-American symposium attended by representatives of many branches of science. It was organized in 1971, and for the first time the topic studied was called "Communication with Extraterrestrial Intelligence" (CETI).

There is another interesting fact. Armenian astronomers at the Byurakan Observatory discovered many new cosmic objects, which are still being studied by many researchers around the world. We have already mentioned Markarian galaxies. There are also the Arakelian galaxies, the Ghazarian galaxies, the Parsamian cometary nebulae, the Gyulbudagian & Maghakian nebulae, the Shahbazian compact groups of compact galaxies, and others.