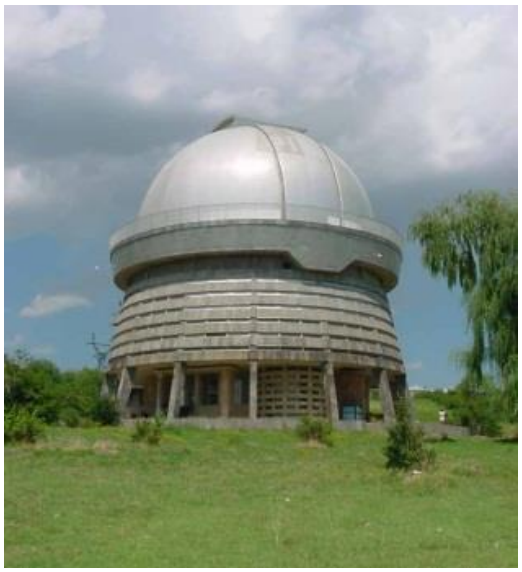
BYURAKAN ASTROPHYSICAL OBSERVATORY in 2013: ANNUAL REPORT

Introduction



In 2013, the Byurakan astronomers continued and development the scientific projects related to **instability phenomena in the Universe** resulted in a number of important discoveries, active **international collaboration**, a number of **research grants** by Byurakan astronomers, organization of a number of meetings, etc. In 2012 BAO got a status of **National Value**, which allowed getting additional funding for the infrastructure and salaries starting from the year 2013. BAO scientists had 3 ANSEF grants in 2013, as well as a French-Armenian (CNRS-SCS) joint project for 2012-2013. There have been **30 publications in refereed journals**, including most important international ones (*ApJ*, *AJ*, *A&A*, *MNRAS*). There were **34 missions** for research and participation in meetings and schools.

One of the most important events in Armenia was the **IAU Symposium #304** organized by BAO astronomers and held in Yerevan during October 7-11. It was dedicated to B.E. Markarian's 100th anniversary. In January 2013, Armenia joined UN COPUOS (Committee for Peaceful Users of the Space) and the Armenian Space Agency was created. In June 2013, BAO joined ICSU World Data System (WDS), in July 2013, ICRANet office in Yerevan was established and Armenia joined the International Planetary Data Alliance (IPDA).

Structure of BAO and research staff

BAO is one of the institutions of the Armenian **National Academy of Sciences (NAS)** and is affiliated to its **Division of Physics and Astrophysics**. BAO is being funded from the state budget through the **State Committee for Science (SCS) of the Ministry of Education and Science**, through Basic Program called *"Evolution of Cosmic Objects through their Activity"*. All researchers and the technical and administrative services, altogether 84 persons, are maintained due to this program. The administration consists of 3 persons: the **Director (*Dr.* Haik Harutyunian)**, the **Deputy Director (*Dr.* Tigran Magakian)**, and the **Scientific Secretary (*Dr.* Elena Nikogossian)**.

There are several research groups headed by Haik Harutyunian, Edward Khachikian, Tigran Magakian, Norair Melikian, Areg Mickaelian, Elma Parsamian, and Artashes Petrosian. Altogether 43 scientists work in these groups. At the end of the year, three groups were awarded state funding for 2014-2015 (PIs: Tigran Magakian, Elena Nikoghosyan, and Artashes Petrosian). Four BAO astronomers were included in the list of 100 most productive scientists in Armenia and receive additional salaries (Tigran Magakian, Areg Mickaelian, Tigran Movsessian and Artashes Petrosian).

Three laboratories of scientific-technical character, namely, the laboratories of the **2.6m telescope** (headed by Tigran Movsessian), **1m Schmidt telescope** (Smbat Balayan), and **Smaller telescopes** (Artur Amirkhanian) service are also parts of Basic Program.

Telescopes and infrastructure

During 2013, a project of reconstruction of BAO **2.6m telescope** was conducted including the aluminization of its mirror and some other works. On this occasion, the President of Armenia *Mr.* Serzh Sargsyan visited Byurakan in November 2013. During the last years, this telescope is the only one providing scientific results. It still needs a basic renewal of all electronic part, particularly the control system. This is one of the most important works of BAO to be done in the nearest years.

The **small telescopes** may serve for smaller research projects and educational purposes, however they do not have modern receivers and other equipment. One of them is being used for visitors for promotional purposes.

BAO has a rich **Photographic plate archive** of some 35,000 plates obtained mostly with 0.5m and 1m Schmidt telescopes and the 2.6m one, and among them the First Byurakan Survey (FBS or Markarian survey) 2000 spectroscopic plates are the most valuable ones. It is now available in digital form (**Digitized First Byurakan Survey, DFBS**) and may be used for further efficient studies at high galactic latitudes. The **Armenian Virtual Observatory (ArVO)** operates based on this survey and other astronomical data obtained and being obtained with our telescopes, as well as data from all world databases and archives.

Research at BAO

The main fields of investigation at BAO relate to non-stable phenomena in the Universe. This includes studies of non-stable stars and related objects in the Galactic Astronomy and activity in galaxies in the Extragalactic Astronomy, as well as search for new objects and large surveys. In addition, a group of theoreticians is always active in Byurakan working on topics initiated by V.A. Ambartsumian (radiative transfer theory, principle of invariance). Several recent directions have been introduced during 1990s and 2000s, such as the Large-Scale Structure of the Universe and (alternative) Cosmology, Infrared Astronomy, X-ray Astronomy, Solar physics, Exoplanets, Virtual Observatories (VOs). To describe the main results obtained during 2013, the abstracts of published papers are given.

Stars and Nebulae (20)

Spectral observations of flare stars in the neighborhood of the sun
Melikian, N. D.; Tamazian, V. S.; Natsvlishvili, R. Sh.; **Karapetian, A. A.** (Ap 56, 8, 2013)
Results of spectral monitoring of the flare stars HU Del, CM Dra, WX UMa, and VW Com by the 2.6-m telescope at the Byurakan Observatory during May-June 2012 with the SCORPIO spectral camera are reported. A strong flare of WX UMa was recorded during the observation period, as well as faint flares of CM Dra and HU Del, while no variations in brightness or equivalent widths were observed for VW Com. During all the recorded flares the maximum brightness corresponded to minimum values of the equivalent widths of the Hα and Hβ emission lines. The energy distribution in the spectrum of WX UMa changed sharply during the flare. The class M6 spectrum of the star transformed into an early type B spectrum. Finally, the appearance of the forbidden oxygen [OI] 6300 A line with an intensity comparable to that of [OI] 5577 A seems to indicate simultaneous release of the energy of the flare in different layers of the chromosphere.

PMS-objects in the star formation region Cep OB3. I. Stars with Hα emission
Nikoghosyan, E. H. (Ap 56, 26, 2013)
Results are presented from a detailed analysis of PMS stars located in the star-formation region that includes the bright part of the ionization front of the molecular cloud Cep B. Slitless spectroscopy is used to detect 149 stars with Ha emission. Models for the distribution of the spectral energy are constructed for 203 PMS stars based on photometric data in the visible and infrared and their basic parameters are determined. A good correlation is observed between the Hα emission intensity and the infrared excess. The relative disk mass and degree of accretion for stars with EW(Hα) > 10A and α > -1.8 are about an order of magnitude greater than for the other stellar objects. The average distance and age of the PMS stars in the cluster are 890 pc and 0.74 million years, respectively. The stars with EW(Hα) > 10A and α > -1.8 are more than 0.5 million years "younger" than the others.

PMS objects in the star formation region Cep OB3. II. Young stellar objects in the Hα nebula Cep B
Nikoghosyan, E. H. (Ap 56, 165, 2013)
Models for the spectral energy distributions of four stellar objects in the bright compact Hα nebula Cep B are constructed. With a high probability, three of them are found to be very young stellar objects of evolutionary class 0/I with ages of 10^4-10^5 years, comparable to the kinematic age of the ionization front of the nebula itself. The IRAS 22551+6221 source associated with Cep B is initiated by heated dust. An intermediate-mass (B2-B3) star of evolutionary class III lies at the center of the ionization front. The local density of PMS stars in the immediate neighborhood of the Cep B nebula exceeds that for the cluster as a whole. It is highly probable that this zone is a local source of a new star-formation stage.

V2494 Cyg: a unique FU Ori type object in the Cygnus OB7 complex
Magakian, T. Yu.; **Nikogossian, E. H.**; **Movsessian, T.**; et al. (MNRAS 432, 2685, 2013)
A photometric and spectral study of the variable star V2494 Cyg in the L 1003 dark cloud is presented. The brightness of the star, formerly known as HH 381 IRS, increased by 2.5 mag in R (probably in the 1980s) and since then has remained nearly constant. Since the brightness increase, V2494 Cyg has illuminated a bipolar cometary nebula. The stellar spectrum has several features typical of the FU Ori (FUor) type, plus it exhibits very strong Hα and forbidden emission lines with high-velocity components. These emission lines originate in the Herbig-Haro (HH) jet near the star. The kinematic age of the jet is consistent with it forming at the time of the outburst leading to the luminosity increase. V2494 Cyg also produces a rather extended outflow; it is the first known FUor with both an observed outburst and a parsec-sized HH flow. The nebula, illuminated by V2494 Cyg, possesses similar morphological and spectral characteristics to Hubble's variable nebula (R Monocerotis/NGC 2261).

The Monitor Project: stellar rotation at 13 Myr. I. A photometric monitoring survey of the young open cluster h Persei
Moraux, E.; …; **Magakian, T.**; …; **Nikogossian, E.**; …; **Movsessian, T. A.** (A&A 560, id.A13, 2013)
Aims: We aim at constraining the angular momentum evolution of low-mass stars by measuring their rotation rates when they begin to evolve freely towards the zero-age main sequence (ZAMS), i.e., after the disk accretion phase has stopped. *Methods:* We conducted a multisite photometric monitoring of the young open cluster h Persei, which has an age of ~13 Myr. The observations were done in the I-band using four different telescopes, and the variability study is sensitive to periods from less than 0.2 day to 20 days. *Results:* Rotation periods are derived for 586 candidate cluster members over the mass range $0.4 \leq M/M_{\odot} \leq 1.4$. The rotation period distribution indicates a slightly higher fraction of fast rotators for the lower mass objects, although the lower and upper envelopes of the rotation period distribution, located respectively at ~0.2-0.3 d and ~10 d, are remarkably flat over the whole mass range. We combine this period distribution with previous results obtained in younger and older clusters to model the angular momentum evolution of low mass stars during the pre-main sequence (PMS) phase. *Conclusions:* The h Per cluster provides the first statistically robust estimate of the rotational period distribution of solar-type and lower mass stars at the end of the PMS accretion phase (≥10 Myr). The results are consistent with models that assume significant core-envelope decoupling during the angular momentum evolution to the ZAMS. Based on observations made with telescopes at the Maidanak Observatory, at the Crimean Astrophysical Observatory, at the Byurakan Observatory, and with MegaPrime/MegaCam on the Canada-France-Hawaii Telescope (CFHT).

Two Epoch Fabry-Perot Observations of FS Tau B
Movsessian, T.; **Magakian, T.**; Moiseev, A. (Protostars and Planets VI, Heidelberg, 2013. P#1K038, 2013)
We present observations obtained with a 6 m telescope (Russia) using the SCORPIO camera with scanning Fabry-Perot interferometer. Two epochs of the observations of the FS T ' au B region in Hα emission (2001 and 2012) allowed us to measure the proper motions for the spectrally separated inner structures of the jet. Unlike of other knots, the bar-shaped structure NE from the source does not have any perceptible proper motion and represents stationary deflecting shock region. In the jet working surface two different radial velocity structures were found. Proper motion of these structures indicates the presence of two separate knots with different velocities in this region. Investigation of Hα profiles toward the source and the bright reflection nebula R1 shows impressive differences. In fact, we observe the single peak profile in the direction of the source and the double peak profile in the direction of reflection nebula. The reflection nebula works as a mirror located just on the axis of the flow and we observe the same source as edge-on system (source) and pole-on system (R1 nebula) simultaneously. We propose the scenario of formation of absorption component, which splits the emission profile, in a wide angle cool wind from the source.

Unstable Objects in Molecular Cloud LDN133
Gyulbudaghian, A. L.; Mendez, R. A. (Ap 56, 531, 2013)

The results of investigation of molecular cloud LDN133 and the unstable objects HHL59, HHL59A, HHL59B and HHL59C connected with it are given. The IR nebula and IR star cluster are also connected with LDN133. It is shown that two different molecular outflows are present: (1) red-shifted molecular outflow from the IR nebula, connected with HHL59, and (2) bipolar molecular outflow from the object HHL59A. An IRAS point source IRAS 17554-2606 is connected with the IR nebula. Observations with narrow band filters revealed the existence of HH objects and jets from several unstable stars of this region. There are three filaments; ejected from the IR nebula with condensation at their ends. Two 8-type cometary nebulae connected with unstable stars were also discovered.

The object SNO 74 in the association Ara OB 1
Gyulbudaghian, A. L. (Ap 56, 214, 2013)
The star formation region SNO 74 embedded in a dark cloud in the association Ara OB 1 is studied. This object is coupled to a compact HII region visible in the IR and to a close cluster of IR stars. 12CO(1-0) observations reveal the existence of red and blue molecular outflows; i.e., this is a bipolar outflow. An image taken with the SIMBA detector at 1.2 mm contains a second active region and a bridge lying to the W of the first active region and accompanied by strong absorption. The red molecular outflow is directed toward this second active region and the bridge.

The sample of FBS cataclysmic variables
Mickaelian, A. M.; **Sinamyan, P. K.** (Proc. IAU S290, p. 275, 2013)
The First Byurakan Survey (FBS) was conducted by Markarian et al. (1989) to reveal UV-excess galaxies. However, many other interesting objects were possible to detect based on its low-dispersion spectra, and the Second part of the FBS (Mickaelian 2008) was carried out later to reveal UV-excess stellar (point-like) objects, such as white dwarfs (WD), hot subdwarfs, cataclysmic variables (CV), HBB stars, as well as QSOs and Seyfert galaxies. In addition, the FBS plates were digitized (DFBS, Digitized First Byurakan Survey; Mickaelian et al. 2007) and the extraction and reduction of spectra allowed selection of objects with higher confidence and to fainter magnitudes. Spectroscopic observations have been carried out with three telescopes (BAO-2.6m, SAO-6m and OHP-1.93m) for classification of objects. The spectral features of CVs are narrow emission lines (Balmer series, HeI and HeII lines and Bowen band at 4640A). In addition, we use the NSVS database for revealing variability and our method of comparison of POSS1 and POSS2 epoch photometric data based on accurate calculations of weighted average POSS1 and POSS2 magnitudes. 27 objects are present in the NSVS and light curves are available. X-ray data may serve as an additional criterion to detect CVs among the FBS blue stellar objects. The subsample of FBS WDs has already been published, where some CVs are also present. The subsample of FBS CVs consists of 38 objects, including the following types: dwarf novae (DN; UG and SU subtypes; 7 objects), nova-like variables (NL; SH, AC, VY subtypes; 11 objects), as well as there is a DQ Her type object (FBS 1140+719), a Helium CV (HeCV; FBS 1232+379), and a Low-mass X-ray Binary (LMXB; FBS 1656+354). Other objects do not have accurate classification because of the lack of photometric data. The Periods are in the range of 0.012 to 0.343 days. To make a complete study of these objects possible, multiwavelength (MW) data were retrieved for these 38 objects, including X-ray (ROSAT BSC and FSC), UV (GALEX), optical (APM, MAPS, USNO-B1.0, GSC 2.3.2, SDSS), and IR (2MASS, WISE, IRAS, AKARI) and MW SEDs were built. For CVs, MW SEDs have some disadvantage as their variability does not allow have their accurate energy distribution. Diagrams with relations between MW data-points and some other physical parameters were also built.

Extension of the C Star Rotation Curve of the Milky Way to 24 kpc
Battinelli, P.; Demers, S.; Rossi, C.; **Gigoyan, K. S.** (Ap 56, 68, 2013)
Demers and Battinelli published in 2007 the rotation curve of the Milky Way based on the radial velocity of carbon (C) stars outside the Solar circle. Since then we have established a new list of candidates for spectroscopy. The goal of this paper is to determine the rotation curve of the Galaxy, as far as possible from the Galactic center, using N-type C stars. The stars were selected from their dereddened 2MASS colors, then the spectra were obtained with the Dominion Astrophysical Observatory and Asiago 1.8 m telescopes. This publication adds radial velocities and Galactrocentric distances of 36 C stars, from which 20 are newly confirmed. The new results for stars up to 25 kpc from the Galactic center suggest that the rotation curve shows a slight decline beyond the Solar circle.

FBS 0137+400: an N-type semiregular variable carbon star
Gigoyan, K. S.; **Kostandyan, G.**; Sarkissian, A.; Russeil, D. (Ap 56, 267, 2013)
Abstract is not available.

Kinematics and chemical properties of the Galactic stellar populations. The HARPS FGK dwarfs sample
Adibekyan, V. Zh.; …; **Hakobyan, A. A.**; et al. (A&A 554, id.A44, 2013)

Aims: We analyzed chemical and kinematical properties of about 850 FGK solar neighborhood long-lived dwarfs observed with the HARPS high-resolution spectrograph. The stars in the sample have log g ≥ 4 dex, 5000 ≤ T_{eff} ≤ 6500 K, and - 1.39 ≤ [Fe/H] ≤ 0.55 dex. The aim of this study is to characterize and explore the kinematics and chemical properties of stellar populations of the Galaxy in order to understand their origins and evolution. *Methods:* We applied a purely chemical analysis approach based on the [α/Fe] vs. [Fe/H] plot to separate Galactic stellar populations into the thin disk, thick disk, and high-α metal-rich (hαmr). Then, we explored the population's stellar orbital eccentricity distributions, their correlation with metallicity, and rotational velocity gradients with metallicity in the Galactic disks to provide constraints on the various formation models. *Results:* We identified a gap in the [α/Fe]-[Fe/H] plane for the α-enhanced stars, and by performing a bootstrapped Monte Carlo test we obtained a probability higher than 99.99% that this gap is not due to small-number statistics. Our analysis shows a negative gradient of the rotational velocity of the thin disk stars with [Fe/H] (-17 km s-1 dex^{-1}), and a steep positive gradient for both the thick disk and hαmr stars with the same magnitude of about +42 km s^{-1} dex^{-1}. For the thin disk stars we observed no correlation between orbital eccentricities and metallicity, but observed a steep negative gradient for the thick disk and hαmr stars with practically the same magnitude (≈-0.18 dex^{-1}). The correlations observed for the nearby stars (on average 45 pc) using high-precision data, in general agree well with the results obtained for the SDSS sample of stars located farther from the Galactic plane. *Conclusions:* Our results suggest that radial migration played an important role in the formation and evolution of the thin disk. For the thick disk stars it is not possible to reach a firm conclusion about their origin. Based on the eccentricity distribution of the thick disk stars only their accretion origin can be ruled out, and the heating and migration scenario could explain the positive steep gradient of Vφ with [Fe/H]. When we analyzed the hαmr stellar population we found that they share properties of both the thin and thick disk population. A comparison of the properties of the hαmr stars with those of the subsample of stars from the N-body/SPH simulation using radial migration suggest that they may have originated from the inner Galaxy. Further detailed investigations would help to clarify their exact nature and origin. Based on observations collected at the La Silla Paranal Observatory, ESO (Chile) with the HARPS spectrograph at the 3.6-m telescope.

On the question of detecting granulation signal in CoRoT light curves of A and B stars
Ghazaryan, S. (AASP 3, 20, 2013)
We applied the procedure written by us to HgMn targets observed both through CoRoT astero and exo channels to check its usefulness for search of possible existence of solar-type granulation signature in their power spectrum. The point is that many articles appeared very recently considering this problem but, we did not find any paper on this issue in relation to chemically peculiar main-sequence stars. Because theoretical models based on atomic diffusion require that the atmospheres of ApBp stars have to be more stable than those of normal stars, presence or absence of granulation on their surfaces should be an interesting information for modelling. The earliest results show that our method is appropriate for analysis of data obtained through astero and exo channels. Nowadays, solar-type granulation effect most likely has not be seen within CoRoT data for the stars we considered. This issue needs further consideration.

Attempt to detect the granulation signature in the HgMn star HD 175640 from CoRoT light curves
Ghazaryan, S.; Alecian, G.; **Harutyunian, H.** (MNRAS 435, 1852, 2013)
HgMn stars are affected by atomic diffusion processes. Because theoretical models based on atomic diffusion require that the atmospheres of ApBp stars have to be much more stable than those of normal stars, the detection or the absence of detection of granulation in them should be an interesting information for the modelling. We would like to address the question of the stability of the atmospheres of HgMn stars by analysing the light curves provided by the Convection Rotation and planetary Transits (CoRoT) satellite. We used the CoRoT light curves of the bright HgMn star HD 175640 observed through asteroseismology channel, to look for granulation signature. We have developed a new quasi-automatic IDL procedure, which allows us to correct abnormal jumps and variations which exist in CoRoT N2 data. The earlier results show that this procedure is an appropriate tool for the analysis of data obtained through asteroseismology and exoplanet channels. Calculations we carried out for this target show that granulation signature in this HgMn star is not detected from CoRoT light curves. On the other hand, we do not detect clear pulsation signal for this star. That shows that even if some HgMn stars are pulsating, this is not a general property of the group.

Physical properties of HgMn stars on the basis of the available data
Ghazaryan, S. (EAS Publications Series 63, p. 411, 2013)
A large database of HgMn stars is compiled, which contains the results of new measurements of their spectroscopic parameters combined with the data available in the literature. This database gives us an idea about the evolutionary changes of the HgMn stars.

Frequencies of Superflares in Solar-Type Stars Detected by the Kepler Orbital Observatory
Akopian, A. A. (Ap 56, 488, 2013)

A statistical study of solar-type stars for which superflares have been observed with the Kepler orbital observatory is presented. Methods developed for solving similar problems for flare stars are invoked to do this. The total number of stars capable of superflares is estimated and the flare frequency distribution is determined for the complete set of stars and for separate subsamples constructed by breaking the complete sample into two parts in terms of the rotation periods and variability amplitudes of the stars. The star KIC 7264976 is found to have a statistically significant variation in its frequency of superflares.

Irradiation of Dust in Molecular Clouds. III. Internal Sources of Stellar UV Photons from A-F-G Dwarf Stars
Yeghikyan, A. G. (Ap 56, 142, 2013)
The radiation fluxes inside interstellar gas-dust molecular clouds as stars of classes A, F, and G pass through the clouds are calculated. It is shown that radiation in the range $912<\lambda<2067$ A penetrates deeply enough to produce an irradiation dose over the time these stars cross the clouds that is high enough to initiate chemical reactions in the ice mantles of dust particles. The possible use of these results for astrophysical interpretation of published data from laboratory experiments on the irradiation of H_2O:CH_3OH:NH_3:CO ice mixtures is discussed. The complex carbon-containing compounds formed during this radiation-induced chemical transformation may play an important role in the prebiological evolution of the dust component of molecular clouds.

On the radii of astrospheres
Yeghikyan, A. G. (Ap 56, 246, 2013)
The characteristics of the astrospheres of convective dwarf stars, such as their radii, mass loss rates, and steady-state outflow rates, are shown by dimensional considerations to be related by simple analytic formulas to the basic parameters of the stars, their mass, radius, and rotation velocity. The rates of mass loss for the 12 cold dwarf stars closest to the sun and the radii of 29 astrospheres are calculated as an example.

Irradiation of dust in molecular clouds. IV. ACR doses
Yeghikyan, A. G.; Barsamyan, L. (Ap 56, 443, 2013)
The fluxes of anomalous cosmic rays inside typical molecular clouds produced during collisions of stars with clouds are calculated. The charged particles formed in the cloud in the neighborhood of the star are accelerated in a shock front in the astrosphere by known statistical mechanisms to energies on the order of a few 100 MeV. It is shown that protons and α-particles with energies in the $1\ \text{keV} \le E \le 10\ \text{GeV}$ range penetrate deeply enough that, over the time of 1-5 hundred thousand years a star is passing through a cloud, they produce sufficient irradiation doses for the ice mantle of dust particles such that the cumulative effect owing to multiple passages would exceed a threshold value on the order of 0.1-1 eV/amu. The possible use of these results for astrophysical interpretation of laboratory experiments on the irradiation of H_2O:CH_3OH:NH_3:CO ice mixtures is discussed. The complex organic substances formed by radiation-chemical transformation may play an important role in the prebiological evolution of the dust component of molecular clouds.

Wavelet-based cross-correlation analysis of the scaling in molecular clouds
Arshakian, T.; Ossenkopf, V. (Protostars and Planets VI, Heidelberg, 2013. P#1B017, 2013)
We develop a wavelet-based cross-correlation (WCC) method to study the correlation between structural changes in molecular clouds as a function of scale. The method compares a pair of maps observed in different tracers or at different velocity ranges. Advantages of the WCC method:
- Allows to measure the correlation coefficient and structural offset between two maps as a function of scale.
- Allows to weight individual pixels by their observational significance.
- Is robust against the noise. Application of the WCC to simulated fBm (fractional Brownian motion) maps reveals that:
- Cross-correlation coefficient can strongly depend on the scale.
- Correlation coefficient and offset can be recovered robustly regardless of noise. Analysis of the G333 molecular line maps (13CO and C18O) shows:
- A large scale gradient in the structural distribution. This could indicate a density structure where every core shows a low density tail towards the South-West mainly seen in 13CO. The WCC can be used to trace the correlated structural changes between different maps of a molecular cloud at scales representing the structural and physical importance such as chemical and phase transitions.

Extragalactic Astronomy (14)

Five Supernova Survey Galaxies in the Southern Hemisphere: Supernova Ia Rates
Hakobyan, A. A.; **Petrosian, A. R.**; Mamon, G. A.; et al. (Proc. IAU S281, p. 24, 2013)

Based on the database of 56 supernovae (SNe) events discovered in 3838 galaxies of the southern hemisphere, we compute the rate of SNe of different types along the Hubble sequence normalized to the optical and near-infrared (NIR) luminosities as well as to the stellar mass of the galaxies. We find that the rates of Type Ia SNe show a dependence on both morphology and colors of the galaxies, and therefore, on the star-formation activity. The rate of SNe Ia can be explained by assuming that at least 15% of Ia events in spiral galaxies originate in relatively young stellar populations. We also find that the rates show no modulation with nuclear activity or environment.

Paired galaxies with different activity levels and their supernovae
Nazaryan, T. A.; **Petrosian, A. R.**; **Hakobyan, A. A.**; …; **Aramyan, L. S.** (ApSS 347, 365, 2013)
We investigate the influence of close neighbor galaxies on the properties of supernovae (SNe) and their host galaxies using 56 SNe located in pairs of galaxies with different levels of star formation (SF) and nuclear activity. The statistical study of SN hosts shows that there is no significant difference between morphologies of hosts in our sample and the larger general sample of SN hosts in the Sloan Digital Sky Survey (SDSS) Data Release 8 (DR8). The mean distance of type II SNe from nuclei of hosts is greater by about a factor of 2 than that of type Ibc SNe. The distributions and mean distances of SNe are consistent with previous results compiled with the larger sample. For the first time it is shown that SNe Ibc are located in pairs with significantly smaller difference of radial velocities between components than pairs containing SNe Ia and II. We consider this as a result of higher star formation rate (SFR) of these closer systems of galaxies. SN types are not correlated with the luminosity ratio of host and neighbor galaxies in pairs. The orientation of SNe with respect to the preferred direction toward neighbor galaxy is found to be isotropic and independent of kinematical properties of the galaxy pair.

On the Nature of Unconfirmed Supernovae
Aramyan, L. S.; **Petrosian, A. R.**; **Hakobyan, A. A.**; …; **Nazaryan, T. A.** (Ap 56, 153, 2013)
We study the nature of 39 unconfirmed supernovae (SNe) from the sky area covered by the Sloan Digital Sky Survey (SDSS) Data Release 8 (DR8), using available photometric and imaging data and intensive literature search. We confirm that 21 objects are real SNe, 2 are Galactic stars, 4 are probable SNe, and 12 remain unconfirmed events. The probable types for 4 objects are suggested: 3 SNe are of probable type Ia, and SN 1953H is probable type II SN. In addition, we identify the host galaxy of SN 1976N and correct the offsets/coordinates of SNe 1958E, 1972F, and 1976N.

Multiwavelength studies of Markarian galaxies
Mickaelian, A. M.; **Abrahamyan, H. V.**; **Paronyan, G. M.**; **Harutyunyan, G. S.** (AN 334, 887, 2013)
Markarian galaxies are the result of the First Byurakan Survey (FBS) conducted in 1965-1980 by B.E. Markarian et al. The sample consists of 1515 UV-excess galaxies containing many active galaxies, both AGN and starburst (SB) galaxies that are interesting from the point of view of galaxy evolution and multiwavelength studies. Several catalogs of Markarian galaxies have been published; however, multiwavelength (MW) data were not provided and matched for more efficient investigations. Moreover, SDSS spectra now give possibility for better classification by activity types, and we have accomplished fine classification obtaining new types and subtypes for most of the objects. We have cross-correlated the Markarian catalogue with all available large-area MW catalogues at various wavelengths, from X-ray to radio: ROSAT BSC and FSC, GALEX, APM, MAPS, USNO B1.0, GSC 2.3.2, SDSS, 2MASS PSC and ESC, WISE, AKARI-IRC, IRAS PSC, FSC, and SSSC, AKARI-FIS, GB6, NVSS, FIRST, SUMSS, WENSS, and 7C providing 35 photometric data-points, as well as the Digitized FBS (DFBS, http://byurakan.phys.uniroma1.it/) and Hamburg Quasar Survey (HQS) low-dispersion spectra. The Armenian Virtual Observatory (ArVO, http://www.aras.am/Arvo/arvo.htm) services have been used for cross-correlations and extraction of DFBS spectra; MW SEDs have been built using the IVOA tools, and MW classification has been accomplished. Diagrams with MW flux ratios have been built to reveal objects with extreme characteristics. The classifications have been matched with these flux ratios. A MW catalog of Markarian galaxies has been compiled.

Signature of Plausible Accreting Supermassive Black Holes in Mrk 261/262 and Mrk 266
Ter-Kazarian, G.; **Sargsyan, L.** (AdAst 2013, id.710906, 2013)
Abstract is not available.

Study of some morphological features of extragalactic radio sources of FRI and FRII types
Andreasyan, R. R.; **Hovhannisyan, M. A.**; **Paronyan, G. M.**; **Abrahamyan, H. V.** (Ap 56, 382, 2013)
Data on more than 650 extragalactic radio sources are used to study the distributions of the spectral indices α and elongations of radio sources in the different Fanaroff-Riley (FR) classes. No large differences are found in the distributions of the spectral indices for FRI and FRII radio sources. The following major morphological

differences among objects in the different FR classes are found in a study of the distribution of the elongation of the extragalactic radio sources: (a) radio images of extragalactic FRII radio sources are more elongated on the average than those of FRI sources; (b) the extragalactic FRI radio sources can be divided into two subtypes with two distribution functions for the elongation parameter K with different maxima. Besides having different average elongations in their radio images, these two subtypes of FRI radio sources should probably also have differences in the orientations of these elongations with respect to the directions of the axes of rotation of the parent optical galaxies, which in most cases coincide with the minor optical axes of the galaxies.

The Investigation of Compact Radio Sources with z>1: Candidates of Distant Quasars
Hovhannisyan M.A.; **Andreasyan R.R.**; **Paronyan G.M.**; **Abrahamyan H.V.** (Rep.NAS RA 113, 281, 2013)
A radio-optical investigation of 30 quasars from the second area (0.097 radian squares) of Cambridge 7C catalogue was carried out to study the physical and morphological characteristics of distant quasars. All of these objects have angular sizes less than a second on the 102 MHz. It have been calculated average values of absolute magnitudes and spectral indexes (M=-26.51+-0.25, alpha=0.66+-0.25) for them. It was shown that 60% of compact radio sources from the FIRST catalogue (1400 MHz) are candidates of distant quasars.

Study of the Byurakan-IRAS galaxy sample
Mickaelian, A. M.; **Harutyunyan, G. S.** (Proc. IAU S292, p. 159, 2013)
The Byurakan-IRAS Galaxy (BIG) sample is the result of optical identifications of IRAS PSC sources at high-galactic latitudes using the First Byurakan Survey (FBS) low-dispersion spectra. Among the 1178 objects most are dusty spiral galaxies and there is a number of ULIRGs among these objects. Our spectroscopic observations carried out with three telescopes (BAO-2.6m, SAO-6m and OHP-1.93m) for 172 galaxies, as well as the SDSS DR8 spectra for 83 galaxies make up the list of 255 spectroscopically studied BIG objects. All but one have emission lines; we have discovered 70 AGN and composite spectrum objects among them and the others are starbursts. All possible physical characteristics have been measured and/or calculated, including radial velocities and distances, angular and physical sizes, absolute magnitudes and luminosities (both optical and IR). IR luminosities and star-formation rates have been calculated from the IR fluxes. Various multiwavelength (MW) data have been retried for the full sample of 1178 objects from recent catalogs from X-ray to radio to make a complete study of these galaxies possible. MW SEDs have been built, which have been matched to their optical classifications.

Byurakan-IRAS galaxies as massive galaxies with nuclear and starburst activity
Mickaelian, A. M.; **Harutyunyan, G. S.** (Proc. IAU S295, p. 182, 2013)
Byurakan-IRAS Galaxies (BIG) (Mickaelian 1995) are the result of optical identifications of IRAS PSC sources at high-galactic latitudes using the First Byurakan Survey (FBS) low-dispersion spectra (Markarian et al. 1989). Among the 1577 targets, 1178 galaxies have been identified. Most are dusty spiral galaxies and here is a number of ULIRGs among these objects. Our spectroscopic observations, carried out with three telescopes (Byurakan Astrophysical Observatory 2.6m, Russian Special Astrophysical Observatory 6m and Observatoire de Haute Provence 1.93m; Mickaelian & Sargsyan 2010), for 172 galaxies, as well as the SDSS DR8 spectra for 83 galaxies make up the list of 255 spectroscopically studied BIG objects. The classification regarding activity type for narrow-line emission galaxies has been carried out using the diagnostic diagrams by Veilleux & Osterbrock (1987). All possible physical characteristics have been measured and/or calculated, including radial velocities and distances, angular and physical sizes, absolute magnitudes and luminosities (both optical and IR). IR luminosities and star-formation rates have been calculated from the IR fluxes (Duc et al. 1997).

Flare-like Variability of the Mg II λ2800 Emission Line in the Γ-Ray Blazar 3C 454.3
Leon-Tavares, J.; …; **Arshakian, T. G.**; et al. (ApJ 763, L36, 2013)
We report the detection of a statistically significant flare-like event in the Mg II λ2800 emission line of 3C 454.3 during the outburst of autumn 2010. The highest levels of emission line flux recorded over the monitoring period (2008-2011) coincide with a superluminal jet component traversing through the radio core. This finding crucially links the broad emission line fluctuations to the non-thermal continuum emission produced by relativistically moving material in the jet and hence to the presence of broad-line region clouds surrounding the radio core. If the radio core were located at several parsecs from the central black hole, then our results would suggest the presence of broad-line region material outside the inner parsec where the canonical broad-line region is envisaged to be located. We briefly discuss the implications of broad emission line material ionized by non-thermal continuum in the context of virial black hole mass estimates and gamma-ray production mechanisms.

The relation between magnetic and material arms in models for spiral galaxies
Moss, D.; …; **Arshakian, T. G.** (A&A 556, id.A147, 2013)
Context: Observations of polarized radio emission show that large-scale (regular) magnetic fields in spiral galaxies are not fully axisymmetric, but generally stronger in interarm regions. In some nearby galaxies such

as NGC 6946 they are organized in narrow magnetic arms situated between the material spiral arms. *Aims:* The phenomenon of magnetic arms and their relation to the optical spiral arms (the material arms) calls for an explanation in the framework of galactic dynamo theory. Several possibilities have been suggested but are not completely satisfactory; here we attempt a consistent investigation. *Methods:* We use a 2D mean-field dynamo model in the no-z approximation and add injections of small-scale magnetic field, taken to result from supernova explosions, to represent the effects of dynamo action on smaller scales. This injection of small scale field is situated along the spiral arms, where star-formation mostly occurs. *Results:* A straightforward explanation of magnetic arms as a result of modulation of the dynamo mechanism by material arms struggles to produce pronounced magnetic arms, at least with realistic parameters, without introducing new effects such as a time lag between Coriolis force and α-effect. In contrast, by taking into account explicitly the small-scale magnetic field that is injected into the arms by the action of the star forming regions that are concentrated there, we can obtain dynamo models with magnetic structures of various forms that can be compared with magnetic arms. These are rather variable entities and their shape changes significantly on timescales of a few 100 Myr. Properties of magnetic arms can be controlled by changing the model parameters. In particular, a lower injection rate of small-scale field makes the magnetic configuration smoother and eliminates distinct magnetic arms. *Conclusions:* We conclude that magnetic arms can be considered as coherent magnetic structures generated by large-scale dynamo action, and associated with spatially modulated small-scale magnetic fluctuations, caused by enhanced star formation rates within the material arms.

Polarized synchrotron radiation from the Andromeda galaxy M31 and background sources at 350 MHz
Gießübel, R.; Heald, G.; Beck, R.; **Arshakian, T. G.** (A&A 559, id.A27, 2013)
Context: Low-frequency radio continuum observations are best suited to search for radio halos of inclined galaxies. Polarization measurements at low frequencies allow the detection of small Faraday rotation measures caused by regular magnetic fields in galaxies and in the foreground of the Milky Way. *Aims:* The detection of low-frequency polarized emission from a spiral galaxy such as M 31 allows us to assess the degree of Faraday depolarization, which can be compared with models of the magnetized interstellar medium. *Methods:* The nearby spiral galaxy M 31 was observed in two overlapping pointings with the Westerbork Synthesis Radio Telescope (WSRT), resulting in about 4' resolution in total intensity and linearly polarized emission. The frequency range 310-376 MHz was covered by 1024 channels, which allowed the application of rotation measure (RM) synthesis on the polarization data. We derived a data cube in Faraday depth and compared two symmetric ranges of negative and positive Faraday depths. This new method avoids the range of high instrumental polarization and allows the detection of very low degrees of polarization. *Results:* For the first time, diffuse polarized emission from a nearby galaxy is detected below 1 GHz. The degree of polarization is only 0.21±0.05%, consistent with the extrapolation of internal depolarization from data at higher radio frequencies. A catalogue of 33 polarized sources and their Faraday rotation in the M 31 field is presented. Their average depolarization is DP(90,20) = 0.14±0.02, which is seven times more strongly depolarized than at 1.4 GHz. We argue that this strong depolarization originates within the sources, for instance in their radio lobes, or in intervening galaxies on the line of sight. On the other hand, the Faraday rotation of the sources is mostly produced in the foreground of the Milky Way and varies significantly across the ~9 square degrees of the M 31 field. *Conclusions:* As expected, polarized emission from M 31 and extragalactic background sources is much weaker at low frequencies than in the GHz range. Future observations with LOFAR, with high sensitivity and high angular resolution to reduce depolarization, may reveal diffuse polarization from the outer disks and halos of galaxies.

Dynamical features of spiral galaxies in the local system, the coma cluster and its surroundings
Kogoshvili, N.; Borchkhadze, T.; **Kalloghlian, A. T.** (Ap 56, 332, 2013)
The dynamical features of spiral galaxies with absolute magnitudes $M \geq -20^m.6$ in the Local system of galaxies, in the Coma cluster, and in its surroundings are studied based on data from the Merged Catalogue of Galaxies (MERCG). The measured diameters of the galaxies are used to determine the radius R_D, regarded as the region where a maximum concentration of dark matter is possible. The dynamic parameters M_{dyn} and M_{dyn} / L_B for the spiral galaxies are calculated using the condition of centrifugal equilibrium, and the theory of angular momentum transfer is used to estimate the central surface density μ_0 and angular momentum K of the stars in these galaxies. A comparison of the dynamical parameters of the spiral galaxies with absolute magnitudes $M \leq -20^m.6$ and $M \geq -20^m.6$ reveals a statistically significant excess in the estimated fraction of dark energy in the galaxies with $M \geq -20^m.6$, their smaller size, and greater number in the Coma cluster and its surroundings.

Relationship of the kinematic properties of cD galactic clusters to their radiative characteristics
Harutyunian, H. A.; **Harutyunyan, V. S.** (Ap 56, 359, 2013)
A possible correlation between the dispersion in the velocities of regular galactic clusters and their total luminosity is discussed. Based on the generally accepted hypothesis that regular galactic clusters are equilibrated systems, we attempt to find a relationship similar to the Faber-Jackson relation between these quantities. The fact that no such relationship was found can be interpreted as a consequence of the

incompleteness of the samples of galaxies that were used or, more likely, of the untenability of the assumption that these clusters are in equilibrium.

Theoretical Astrophysics (5)

Solution of Linear Radiative Transfer Problems in Plane-Parallel Atmospheres. III
Nikoghossian, A. G. (Ap 56, 130, 2013)
This paper examines the problem of determining the statistical averages describing the diffusion of radiation in an inhomogeneous plane-parallel atmosphere. The method of invariant imbedding is used to find the mean number of scattering events and the average traveling time of different groups of photons in the medium. In all cases the problem reduces to solving integro-differential equations of the same form with specified initial conditions, which is easy to realize by numerical calculation.

Role of the Reflection Function in Describing the Diffusion of Radiation in Plane-Parallel Inhomogeneous Atmospheres
Nikoghossian, A. G. (Ap 56, 553, 2013)
Recent results by the author on radiative transfer problems in inhomogeneous atmospheres are analyzed. With three of the most often encountered astrophysical problems as examples, the advantages of this approach, which is based on the concept of invariant embedding, are demonstrated. Particular attention is devoted to the important role played by the reflection function in determining the radiation field in a medium and a number of the characteristics of radiative diffusion in it.

Ultra-high energy neutrino fluxes from supermassive AGN black holes
Ter-Kazarian, G. (ApSS, 2013)
We compute the ultra-high energy (UHE) neutrino fluxes from plausible accreting supermassive black holes closely linking to the 377 active galactic nuclei (AGNs). They have well-determined black hole masses collected from the literature. The neutrinos are produced via simple or modified URCA processes, even after the neutrino trapping, in superdense proto-matter medium. The resulting fluxes are ranging from: (1) (quark reactions) — $J^{q}\_{v\varepsilon}/(\varepsilond$ erg cm^{-2} s^{-1} sr^{-1}) $\cong$ 8.29×10^{-16} to 3.18×10-4, with the average overline $J^{q}\_{v\varepsilon} \cong 5.53\times10^{-10}\varepsilond$ erg cm^{-2} s^{-1} sr^{-1}, where ε d ~10^{-12} is the opening parameter; (2) (pionic reactions) — $J^{\pi}\_{v\varepsilon} \cong 0.112J^{q}\_{v\varepsilon}$, with the average $J^{\pi}\_{v\varepsilon} \cong 3.66\times10^{-11}\varepsilond$ erg cm^{-2} s^{-1} sr^{-1}; and (3) (modified URCA processes) — $J^{URCA}\_{v\varepsilon} \cong 7.39\times10^{-11}$ Jq_{v\varepsilon}, with the average overline $J^{URCA}\_{v\varepsilon} \cong 2.41\times10^{-20}$ \varepsilond erg cm^{-2} s^{-1} sr^{-1}. We conclude that the AGNs are favored as promising pure neutrino sources, because the computed neutrino fluxes are highly beamed along the plane of accretion disk, peaked at high energies and collimated in smaller opening angle $\theta \sim \varepsilon_d$.

Is there an inertia due to the supersymmetry
Ter-Kazarian, G. (eprint arXiv:1303.3180, 2013)
We derive a standard Lorentz code (SLC) of motion by exploring rigid double transformations of, so-called, 'master space-induced' supersymmetry (MS-SUSY), subject to certain rules. The renormalizable and actually finite flat-space field theories with N_{max}=4 supersymmetries in four dimensions, if only such symmetries are fundamental to nature, yield the possible 'extension of Lorentz code' (ELC), at which the SLC violating new physics appears. In the framework of local MS-SUSY, we address the inertial effects. We argue that a space-time deformation of MS is the origin of inertia effects that can be observed by us. We go beyond the hypothesis of locality. This allows to improve the relevant geometrical structures referred to the noninertial frame in Minkowski space for an arbitrary velocities and characteristic acceleration lengths. This framework furnishes justification for the introduction of the 'weak' principle of equivalence, i.e., the 'universality of free fall'. The implications of the inertia effects in the more general post-Riemannian geometry are
briefly discussed.

Classical analog of extended phase space SUSY and its breaking
Ter-Kazarian, G. (eprint arXiv:1306.2271, 2013)
We derive the classical analog of the extended phase space quantum mechanics of the particle with odd degrees of freedom which gives rise to (N=2)-realization of supersymmetry (SUSY) algebra. By means of an iterative procedure, we find the approximate groundstate solutions to the extended Schrodinger-like equation and use these solutions further to calculate the parameters which measure the breaking of extended SUSY such as the groundstate energy. Consequently, we calculate a more practical measure for the SUSY breaking which is the expectation value of an auxiliary field. We analyze non-perturbative mechanism for extended phase space SUSY breaking in the instanton picture and show that this has resulted from tunneling between

the classical vacua of the theory. Particular attention is given to the algebraic properties of shape invariance and spectrum generating algebra.

Meetings held in Byurakan and Yerevan

Armenian Astronomical School Olympiad, 22 Apr 2013
The final stage of the annual astronomical contest for school pupils and selection of candidates for the International Astronomical Olympiad.

4th Byurakan Summer School (4BSS) for YSU students / IAU S304 training, 19-23 Aug 2013
The 4th traditional Byurakan Summer School for YSU undergraduate students was held in combination with the IAU S304 training courses for students of the LOC supporting teams selected from several universities.

Armenian-Georgian (Byurakan-Abastoumani) XIV Joint Colloquium, 26-28 Aug 2013
The XIV Joint Colloquium of the Byurakan and Abastoumani astrophysical observatories on *"Instability and Evolution of Stars"* was dedicated to L.V. Mirzoyan's 90th anniversary. There were 23 Armenian and 12 Georgian participants.

IAU Symposium #304: Multiwavelength AGN Surveys and Studies, 7-11 Oct 2013, Yerevan
The symposium was dedicated to B.E. Markarian's 100th anniversary and was held at the Conference hall of the Presidum of Armenian National Academy of Sciences and was the biggest by the number of participants (141) and reperesented countries (29).

ArAS XII Annual Meeting, 27 Dec 2013, Yerevan
ArAS XII annual meeting was only an administrative one, without a scientific session. ArAS annual report was given at the Armenian National Academy of Sciences as a Summary of the astronomical year 2013.

Research grants

International research grants support the research at BAO and are a significant contribution compared to the low level of national funding. In 2013, following projects were active:

ANSEF (2013): *"Software for control 1m telescope BAO"*, PI: **S.K. Balayan**; *"Supernovae distribution and host galaxy properties"*, PI: **Artur Hakobyan**; *"Investigation of the internal structures in the jets from young stars" (William Mesrobian Astronomy Award)*, PI: **Tigran Movsessian**

CNRS-SCS (2012-2013): *"Supernovae Host Galaxies in the SDSS DR8"*, PIs: ***Artashes Petrosian*** and ***Daniel Kunth*** *(IAP, France)*

Local grants are given by the Armenian Ministry of Education and Science State Committee for Science (SCS):

Thematic grants PIs: Tigran Magakian, Elena Nikoghosyan, and Artashes Petrosian

Most productive scientists: Tigran Magakian, Areg Mickaelian, Tigran Movsessian and Artashes Petrosian

Academic Visits

Altogether, 18 Byurakan scientists had 34 academic visits to astronomical centres of 14 countries (USA, France, Germany, Italy, Switzerland, Poland, Romania, Greece, Finland, Russia, Lithuania, Estonia, Brazil, and Artsakh) (compared to 35 visits to 14 countries by 21 scientists in 2012, 34 visits to 11 countries by 18 scientists in 2012, 33 visits to 13 countries by 17 scientists in 2010 and 17 visits to 6 countries by 11 scientists in 2009). As before, most active collaboration was with French institutions (altogether 9 visits by 8 scientists). Four times Armenian scientists visited Italy, three times USA, Russia, Romania, and Artsakh (each), twice – Germany. Out of the 34 visits, 19 have been accomplished for research work in frame of collaborations (France, USA, Russia, Italy, and

Germany), 8 for participation in meetings (including the European annual meeting JENAM/EWASS-2013), 3 for lectures, 1 for seminars, 1 for discussion of collaboration, and 2 in international astronomical Olympiads (as the team supervisors).

Areg Mickaelian	Rolle, Switzerland	6 days	23.01-28.01	meeting
Haik Harutyunian	Rome/Pescara, Italy	1 week	16.02-26.02	meeting
Artur Karapetyan	Kislovodsk, Russia	3 weeks	09.04-30.04	observ.
Elena Nikoghosyan	Kislovodsk, Russia	3 weeks	09.04-30.04	observ.
Satenik Ghazaryan	Paris, France	3 months	23.04-20.07	work
Anahit Samsonyan	Cornell University, USA	2 months	29.04-07.06	work
Artur Hakobyan	Padua, Italy	2 month	01.05-30.06	work
Areg Mickaelian	Stepanakert/Shushi, Artsakh	4 days	05.05-08.05	lectures
Hovhannes Pikichyan	Stepanakert/Shushi, Artsakh	4 days	05.05-08.05	lectures
Gohar Harutyunyan	Stepanakert/Shushi, Artsakh	4 days	05.05-08.05	lectures
Artashes Petrosian	STScI, Baltimore, USA	3 weeks	01.07-23.07	work
Kamo Gigoyan	Marseille, France	3 weeks	01.07-21.07	work
Areg Mickaelian	Turku, Finland	1 week	07.07-13.07	meeting
Edward Khachikian	Caltech, USA	2 months	07.07-07.09	work
Tigran Movsisyan	Germany	11 days	13.07-23.07	meeting
Areg Mickaelian	Paris, France	1 week	14.07-20.07	meeting
Marietta Gyulzadyan	Volos, Greece	11 days	24.07-06.08	Olympiad
Marietta Gyulzadyan	Dubingay, Lithuania	1 week	06.09-14.09	Olympiad
Hayk Abrahamyan	Bucharest, Romania	1 week	23.09-30.09	meeting
Gohar Harutyunyan	Bucharest, Romania	1 week	23.09-30.09	meeting
Vahagn Harutyunyan	Bucharest, Romania	1 week	23.09-30.09	meeting
Areg Mickaelian	Potsdam, Germany	2 months	21.10-19.12	work
Artashes Petrosian	Paris, France	1 month	03.11-30.11	work
Artur Hakobyan	Paris, France	1 month	03.11-30.11	work
Tigran Nazaryan	Paris, France	2 weeks	03.11-16.11	work
Levon Aramyan	Paris, France	2 weeks	04.11-16.11	work
Satenik Ghazaryan	Paris, France	2 weeks	04.11-19.11	work
Levon Aramyan	Padua, Italy	1 week	17.11-24.11	work
Satenik Ghazaryan	Brazil	1 week	20.11-27.11	work
Haik Harutyunian	Paris, France	1 month	10.11-27.11	work
Tigran Movsisyan	SAO, Russia	1 week	23.11-30.11	work
Areg Mickaelian	Tartu, Estonia	1 week	01.12-07.12	seminars
Vahagn Harutyunyan	Rome/Pescara, Italy	3 months	09.12-28.02	work
Areg Mickaelian	Warsaw/Torun, Poland	4 days	12.12-16.12	collab-tion

Visits of foreign scientists and other guests

Altogether 139 scientists and other guests from 30 countries visited Byurakan during 2013. Most of the guests (110) were for the IAU Syposium #304.

7-22 Aug, Three scientists from the Crimean Astrophysical Observatory (CrAO) for BAO 2.6m telescope works

12 Aug, **Daniel Kunth** (IAP, France), seminar

26-30 Aug, **XIV Armenian-Georgian Astronomical Colloquium participants**, 12 Georgian scientists

11 Sep – 3 Oct, Four scientists from the Crimean Astrophysical Observatory (CrAO) for BAO 2.6m telescope works

4 Oct, **Massimo Turatto** (Padua, Italy), seminar

9 Oct, **IAU S304 participants**, 110 scientists from 29 countries

17 Oct, **Valerie de Lapparent** (IAP, France), seminar

21 Oct, **A.M. Eigenson** (Lviv National University, Ukraine), seminar

29 Nov – 3 Dec, **Boris Zacharov** (Proekt-Tekhinka, Moscow, Russia), for BAO 2.6m telescope works consulting

Participation in Meetings

During 2013, Byurakan astronomers have participated in 13 meetings, including a number of important international ones, such as the JENAM/EWASS-2013 and ASTRONET meeting in Turku, Finland, as well as other meetings in Switzerland, Italy, France, astronomical school in Romania, the International Astronomical Olympiads in Greece and Lithuania, as well as meetings and seminars in Yerevan and Byurakan: IAU S304, Armenian-Georgian Colloquium, 4th Byurakan Summer School (4BSS), etc.

EAS Affiliated Societies meeting, 24-25 Jan 2013, Rolle, Switzerland (A.M. Mickaelian)

Governing Committee Meeting of the International Centre for Relativistic Astrophysics Network (ICRANet), 18-22 Feb 2013, Rome/Pescara, Italy (H.A. Harutyunian)

Armenian Astronomical School Olympiad, 22 April 2013 (Jury members: A.A. Akopian (Chair), A.E. Grigoryan, M.V. Gyulzadian, E.L. Karapetian, A.M. Mickaelian, T.A. Nazaryan, S.Ye. Nersisyan, A.G. Yeghikian)

Joint European and National Astronomical Meeting / European Week of Astronomy and Space Science (JENAM/EWASS-2013), 8-12 July 2013, Turku, Finland; Special Sessions #1 and #6 (A.M. Mickaelian)

ASTRONET meeting, 13 July 2013, Turku, Finland (A.M. Mickaelian)

International Planetary Data Alliance meeting, 16-18 July 2013, Paris, France (A.M. Mickaelian)

7th International Olympiad on Astronomy and Astrophysics (IOAA), 25 July – 5 Aug 2013, Volos, Greece (M.V. Gyulzadian)

4th Byurakan Summer School (4BSS), 19-23 Aug 2013, Byurakan, Armenia (A.M. Mickaelian, H.A. Harutyunian, T.Yu. Magakian, H.V. Abrahamyan, G.S. Harutyunyan)

XIV Armenian-Georgian Colloquium, 26-28 Aug 2013, Byurakan, Armenia (R. Andreasyan, S. Ghazaryan, A. Gyulbudaghian, S. Hakopian, H. Harutyunian, V. Harutyunyan, A.Karapetian, A. Mahtessian, N. Melikian, A. Mickaelian, T. Movsessian, T. Magakyan, T.Nazaryan, A. Petrosian, A. Hakobyan, L. Aramyan, A. Nikoghossian, E.Nikoghosyan, N. Azatyan, G. Ohanyan, H. Pikichyan)

18th International Astronomical Olympiad (IAO), 6-14 Sep 2013, Dubingay, Lithuania (M.V. Gyulzadian)

NEON school, 23-27 Sep 2013, Bucharest, Romania (Hayk Abrahamyan, Gohar Harutyunyan, Vahagn Harutyunyan)

IAU S304: Multiwavelength AGN Surveys and Studies, 7-11 Oct 2013, Yerevan, Armenia (Hayk Abrahamyan, Arthur Amirkhanian, Ruben Andreasyan, Levon Aramyan, Tigran Arshakian, Norayr Asatrian, Anahit Egikian, Lidia Erastova, Marietta Gyulzadyan, Susanna Hakopian, Haik Harutyunian, Gohar Harutyunyan, Martik Hovhannisyan, Areg Mickaelian, Tigran Nazaryan, Gabriel Ohanian, Gurgen Paronyan)

ArAS XII Annual Meeting, 27 Dec 2013, Yerevan, Armenia (ArAS BAO staff members)

Talks, posters and lectures presented at meetings and schools

During 2013, Byurakan astronomers presented invited, oral and poster contributions at 6 meetings (in France, Finland, Switzerland, Yerevan and Byurakan) and gave lectures at the 4th Byurakan Summer School (4BSS). Altogether, there were 2 invited talks, 25 contributed talks, 20 posters, 7 lectures, and 1 report.

EAS Affiliated Societies meeting, 24-25 Jan 2013, Rolle, Switzerland (1 oral talk)
A.M. Mickaelian: *"The Armenian Astronomical Society in 2012"* (oral talk)

JENAM/EWASS-2013, 8-13 July 2013, Turku, Finland (2 oral talks)
Special Session 1: Astronomy education and public outreach:
A.M. Mickaelian: "Astronomy education and public outreach in Armenia" (oral talk)
Special Session 6: AGN, galaxy mergers, supermassive black holes and gravitational waves:
A.M. Mickaelian: "Interacting/merging pairs and multiples and the interrelationship between starburst, nuclear activity and interactions/merging phenomena"

International Planetary Data Alliance meeting, 16-18 July 2013, Paris, France (1 oral talk)
A.M. Mickaelian: *"Armenian planetary space activities"*

4th Byurakan Summer School (4BSS), 19-23 Aug 2013, Byurakan, Armenia (7 lectures)
H.A. Harutyunian: *"Viktor Ambartsumian and the Byurakan Astrophysical Observatory"*
A.M. Mickaelian: *"Our understanding of the Universe" (general overview)*
H.V. Abrahamyan: *"Solar System"*
T.Yu. Magakian: *"Stars and Nebulae"*
G.S. Harutyunyan: *"Galaxies and Cosmology"*
H.A. Harutyunian: *"Theoretical Astrophysics"*
A.M. Mickaelian: *"Astronomer's tools"*

Armenian-Georgian Colloquium, 26-28 Aug 2013, Byurakan, Armenia (18 oral talks)
R. Andreasyan, S.Balayan, V.H. Movsesyan – Structure of the Magnetic Field Near the Galactic Plane
L. Aramyan, A. Petrosian, A.Hakobyan, D. Kunth, M. Turatto, G. Mamon, V. Adibekyan, T. Nazaryan – On the Nature of Unconfirmed Supernovae
S. Ghazaryan – Physical and chemical parameters of HgMn stars on the basis of the available data
A. Gyulbudaghian – Two Cases of Unusual Molecular Outflows
S. Hakopian – Low Activity Galaxies of SBS in Its Seven Selected Fields
H. Harutyunian – Accelerated expansion of the Universe as the most powerful source of the energy release in cosmic objects
V. Harutyunyan, H. Harutyunian – Relation of Kinematical Properties of cD Clusters of Galaxies with Their Radiative Characteristics
A.Karapetian – The Search of Emission Objects in Khavtasi Dark Clouds Regions
A. Mahtessian – The Luminosity Function of Galaxies
N. Melikian – Continuous Emission during the Stellar Flares
A. Mickaelian – The Joint IRAS PSC/FSC catalogue as a tool for efficient studies for extragalactic IR sources
A. Mickaelian – X-ray selected stars in HRC and BHRC catalogues
T. Movsessian, T. Magakyan – Inner structure of the jets from YSO's
T.Nazaryan, A. Petrosian, A. Hakobyan, V.Adibekyan, D. Kunth, G.A. Mamon, M.Turatto, L. Aramyan – Paired galaxies with different activity levels and their supernovae
A. Nikoghossian – The Reflection Properties of an Atmosphere as Characteristics of the Radiation Diffusion in IT
E.Nikoghosyan, N. Azatyan – The cluster of PMS stars in the vicinity of IRAS 05137+3919
G. Ohanyan – The energetic budget of AGN
H. Pikichyan – Internal Field Problem of Nonlinear Radiative Transfer

IAU S304: Multiwavelength AGN Surveys and Studies, 7-11 Oct 2013, Yerevan, Armenia (2 invited talks, 3 contributed talks and 20 posters)
Invited talks:
Areg Mickaelian (Armenia) - Markarian survey and Markarian galaxies (Invited)
Yervant Terzian (USA), Edward Khachikian (Armenia) - AGNs with Double and Multiple Nuclei (Invited)
Contributed talks:
Tigran Arshakian (Germany/Armenia) - The central pc-scale region in radio-loud AGN: insights from multi-band observations
Tigran Nazaryan (Armenia) - Comparative study of close pairs of galaxies with different activity levels

Haik Harutyunian (Armenia) - Are there systems of objects beyond the dark energy influence?

Posters:

P01: Hayk Abrahamyan; A.M. Mickaelian: *Investigation of Extragalactic Radio Sources on the basis of Cross-Matching of Different Radio Catalogs*

P02: Hayk Abrahamyan; A.M. Mickaelian; G.M. Paronyan: *Radio Properties of AGN*

P05: Arthur S. Amirkhanian; A.G. Egikian; A. del Olmo; H. Tiersch; D. Stoll; H. Perea: *AGN populations in compact groups of galaxies*

P07: Ruben Andreasyan; M. Hovhannisyan; G. Paronyan; H. Abrahamyan: *The study of some morphological features of extragalactic radio sources of FRI and FRII types*

P08: Levon Aramyan; A. A. Hakobyan; V. Zh. Adibekyan; A. R. Petrosian; L. S. Aramyan; G. A. Mamon; D. Kunth; V. de Lapparent; E. Bertin; J. M. Gomes; M. Turatto: *The links between SNe frequencies and activity level of host galaxies*

P09: Levon Aramyan; A. A. Hakobyan; V. Zh. Adibekyan; A. R. Petrosian; L. S. Aramyan; G. A. Mamon; D. Kunth; V. de Lapparent; E. Bertin; J. M. Gomes; M. Turatto: *The distribution of SNe in AGN host galaxies*

P11: Norayr Asatrian: *Hour-timescale profile variations in the broad Balmer lines of the Seyfert galaxy Markarian 6*

P24: Marietta V. Gyulzadyan; V.Z. Adibekyan: *The physical conditions and oxygen and nitrogen abundance of 36 SBS galaxies from the SDSS DR7*

P26: Susanna Hakopian: *Complex Investigation of SBS Galaxies in Seven Selected Fields*

P27: Susanna Hakopian; S. Balayan; T. Movsesyan: *Selected Results of Panoramic Spectroscopy of Some FBS Galaxies*

P28: Gohar Harutyunyan; A.M. Mickaelian: *Analysis and Statistics of the Spectroscopic Sample of Byurakan-IRAS Galaxies*

P29: Gohar Harutyunyan; A.M. Mickaelian: *Study of Starburst/Activity/Interaction Phenomena based on the Multiple ByurakanIRAS Galaxies*

P34: Martik Hovhannisyan; R. Andreasyan; G. Paronyan; H. Abrahamyan: *The Investigation of Distant Quasars*

P43: Areg M. Mickaelian; H.V. Abrahamyan; G.S. Harutyunyan; G.M. Paronyan: *Revised activity types for Markarian galaxies*

P47: Tigran A. Nazaryan; A.R. Petrosian; A.A. Hakobyan; V.Zh. Adibekyan; D. Kunth; G.A. Mamon; M. Turatto; L.S. Aramyan: *Close environments of supernovae host galaxies*

P48: Gabriel Ohanian: *The Role of Radio Loud Phase of Nuclear Activity in Galaxy Formation and Evolution*

P49: Gurgen Paronyan; H. Abrahamyan; G. Harutyunyan; A. Mickaelian: *The ROSAT/NVSS AGN sample*

P50: Gurgen Paronyan; G. Harutyunyan; A. Mickaelian: *Activity types for X-ray candidate AGN from SDSS*

P51: Gurgen Paronyan; A. Mickaelian; H. Abrahamyan: *Study of Homogeneous X-ray AGN sample*

P60: Lidia Erastova: *Morphology the sample of active galaxies from SBS*

ArAS XII Annual Meeting, 27 Dec 2013, Yerevan, Armenia (1 report)

A.M. Mickaelian: *"Summary of the astronomical year 2013"* (annual report)

Seminars

BAO general seminars

11.03, Byurakan	**Marietta Gyulzadyan** (BAO): Study of SBS galaxies and their relation to Zwicky clusters
17.06, Byurakan	**Ararat Yeghikian** (BAO): Radiation-chemical transformation of molecules in interstellar clouds
01.07, Byurakan	**Ararat Yeghikian** (BAO): Radiation-chemical transformation of molecules in interstellar clouds (continuation)
29.07, Byurakan	**Satenik Ghazaryan** (BAO): Physical and chemical properties of HgMn stars
05.08, Byurakan	**Areg Mickaelian** (BAO): Astronomy in the European countries and in Armenia: some quantitative comparisons
12.08, Byurakan	**Daniel Kunth** (IAP, France): L-alpha line as a tool for explanation of the distant Universe
04.10, Byurakan	**Massimo Turatto** (Padua, Italy): *The present and future use of a mid-size telescope for transient. The case of the 1.8m telescope in Asiago*
17.10, Byurakan	**Valerie de Lapparent** (IAP, France): *Challenges of galaxy morphometry for studying galaxy evolution*

21.10, Byurakan	**A.M. Eigenson** (Lviv National University, Ukraine): *Investigation of Time Series by Methods of Multidimensional Analysis. Possible applications in astronomy*

Foreign seminars

18.11, AIP, Germany	**Areg Mickaelian**: *Search and Studies of Active Galaxies in the Byurakan Astrophysical Observatory*
03.12, Tartu Obs., Estonia	**Areg Mickaelian**: *Multiwavelength Studies of Active Galaxies*
05.12, Tartu Univ., Estonia	**Areg Mickaelian**: *Byurakan Astrophysical Observatory and its activities*
10.12, Koeln Univ., Germany	**Areg Mickaelian**: *Multiwavelength Studies of Active Galaxies*
17.12, AIP, Germany	**Areg Mickaelian**: *Multiwavelength Properties of Active Galaxies*

Publications

During 2013, Byurakan astronomers published 30 papers in refereed journals (including 17 in *Astrophysics*, 1 in *ApJ*, 4 in *A&A*, 2 in *MNRAS*, 1 in *Astronomische Nachrichten*, 2 in *Astrophysics and Space Science*, 1 in *Advances in Astronomy and Space Physics*, 1 in *Advances in Astronomy*, and 1 in *Reports of the National Academy of Sciences of Armenia*), 7 in proceedings of 6 meetings, and 2 preprints, as well as a booklet devoted to Beniamin Markarian was published. Numerous information materials and popular articles were published as well. Compared to 2012, the number of refereed papers is the same and there is slight decrease in other publications.

Refereed journal papers

Leon-Tavares, J.; Chavushyan, V.; Patino-Alvarez, V.; Valtaoja, E.; **Arshakian, T. G.**; Popovic, L. C.; Tornikoski, M.; Lobanov, A.; Carraminana, A.; Carrasco, L.; Lahteenmaki, A. – Flare-like Variability of the Mg II λ2800 Emission Line in the Γ-Ray Blazar 3C 454.3 // *The Astrophysical Journal Letters, Volume 763, Issue 2, article id. L36, 6 pp., 02/2013.*

Melikian, N. D.; Tamazian, V. S.; Natsvlishvili, R. Sh.; **Karapetian, A. A.** – Spectral observations of flare stars in the neighborhood of the sun // *Astrophysics, Volume 56, Issue 1, pp. 8-18, 03/2013.*

Nikoghosyan, E. H. - PMS-objects in the star formation region Cep OB3. I. Stars with H? emission // *Astrophysics, Volume 56, Issue 1, pp. 26-41, 03/2013.*

Battinelli, P.; Demers, S.; Rossi, C.; **Gigoyan, K. S.** – Extension of the C Star Rotation Curve of the Milky Way to 24 kpc // *Astrophysics, Volume 56, Issue 1, pp. 68-75, 03/2013.*

Nikoghossian, A. G. – Solution of Linear Radiative Transfer Problems in Plane-Parallel Atmospheres. III // *Astrophysics, Volume 56, Issue 1, pp. 130-141, 03/2013.*

Yeghikyan, A. G. – Irradiation of Dust in Molecular Clouds. III. Internal Sources of Stellar UV Photons from A-F-G Dwarf Stars // *Astrophysics, Volume 56, Issue 1, pp. 142-151, 03/2013.*

Aramyan, L. S.; **Petrosian, A. R.**; **Hakobyan, A. A.**; Mamon, G. A.; Kunth, D.; Turatto, M.; Adibekyan, V. Zh.; **Nazaryan, T. A.** – On the Nature of Unconfirmed Supernovae // *Astrophysics, Volume 56, Issue 2, pp. 153-164, 06/2013.*

Nikoghosyan, E. H. – PMS objects in the star formation region Cep OB3. II. Young stellar objects in the H? nebula Cep B // *Astrophysics, Volume 56, Issue 2, pp. 165-172, 06/2013.*

Gyulbudaghian, A. L. – The object SNO 74 in the association Ara OB 1 // *Astrophysics, Volume 56, Issue 2, pp. 214-220, 06/2013.*

Yeghikyan, A. G. – On the radii of astrospheres // *Astrophysics, Volume 56, Issue 2, pp. 246-254, 06/2013.*

Gigoyan, K. S.; **Kostandyan, G.**; Sarkissian, A.; Russeil, D. – FBS 0137+400: an N-type semiregular variable carbon star // *Astrophysics, Volume 56, Issue 2, pp. 267-270, 06/2013.*

Adibekyan, V. Zh.; Figueira, P.; Santos, N. C.; **Hakobyan, A. A.**; Sousa, S. G.; Pace, G.; Delgado Mena, E.; Robin, A. C.; Israelian, G.; Gonzalez Hernandez, J. I. – Kinematics and chemical properties of the Galactic stellar populations. The HARPS FGK dwarfs sample // *Astronomy & Astrophysics, Volume 554, id.A44, 8 pp., 06/2013.*

Magakian, T. Yu.; **Nikogossian, E. H.**; **Movsessian, T.**; Moiseev, A.; Aspin, C.; Davis, C. J.; Pyo, T.-S.; Khanzadyan, T.; Froebrich, D.; Smith, M. D.; Moriarty-Schieven, G. H.; Beck, T. L. – V2494 Cyg: a unique FU Ori type object in the Cygnus OB7 complex // *Monthly Notices of the Royal Astronomical Society, Volume 432, Issue 4, p. 2685-2695, 07/2013.*

Moss, D.; Beck, R.; Sokoloff, D.; Stepanov, R.; Krause, M.; **Arshakian, T. G.** – The relation between magnetic and material arms in models for spiral galaxies // *Astronomy & Astrophysics, Volume 556, id.A147, 11 pp., 08/2013.*

Ghazaryan, S. – On the question of detecting granulation signal in CoRoT light curves of A and B stars // *Advances in Astronomy and Space Physics, Vol. 3, p. 20-22, 08/2013.*

Kogoshvili, N.; Borchkhadze, T.; **Kalloghlian, A. T.** – Dynamical features of spiral galaxies in the local system, the coma cluster and its surroundings // *Astrophysics, Volume 56, Issue 3, pp. 332-342, 09/2013.*

Harutyunian, H. A.; **Harutyunyan, V. S.** – Relationship of the kinematic properties of cD galactic clusters to their radiative characteristics // *Astrophysics, Volume 56, Issue 3, pp. 359-369, 09/2013.*

Andreasyan, R. R.; **Hovhannisyan, M. A.**; **Paronyan, G. M.**; **Abrahamyan, H. V.** – Study of some morphological features of extragalactic radio sources of FRI and FRII types // *Astrophysics, Volume 56, Issue 3, pp. 382-394, 09/2013.*

Yeghikyan, A. G.; Barsamyan, L. – Irradiation of dust in molecular clouds. IV. ACR doses // *Astrophysics, Volume 56, Issue 3, pp. 443-452, 09/2013.*

Mickaelian, A. M.; **Abrahamyan, H. V.**; **Paronyan, G. M.**; **Harutyunyan, G. S.** – Multiwavelength studies of Markarian galaxies // *Astronomische Nachrichten, Vol.334, Issue 8, p. 887, 10/2013.*

Nazaryan, T. A.; **Petrosian, A. R.**; **Hakobyan, A. A.**; Adibekyan, V. Z.; Kunth, D.; Mamon, G. A.; Turatto, M.; **Aramyan, L. S.** – Paired galaxies with different activity levels and their supernovae // *Astrophysics and Space Science, Volume 347, Issue 2, pp. 365-374, 10/2013.*

Ghazaryan, S.; Alecian, G.; **Harutyunian, H.** – Attempt to detect the granulation signature in the HgMn star HD 175640 from CoRoT light curves // *Monthly Notices of the Royal Astronomical Society, Volume 435, Issue 3, p. 1852-1856, 11/2013.*

Gießübel, R.; Heald, G.; Beck, R.; **Arshakian, T. G.** – Polarized synchrotron radiation from the Andromeda galaxy M31 and background sources at 350 MHz // *Astronomy & Astrophysics, Volume 559, id.A27, 17 pp., 11/2013.*

Hovhannisyan, M. A.; **Andreasyan, R. R.**; **Paronyan, G. M.**; **Abrahamyan, H. V.** – The Investigation of Compact Radio Sources with z>1: Candidates of Distant Quasars // *Reports, National Academy of Sciences of Armenia, Vol. 113, No. 3, p. 281-289, 11/2013.*

Ter-Kazarian, G. – Ultra-high energy neutrino fluxes from supermassive AGN black holes // *Astrophysics and Space Science, Online First, 11/2013.*

Akopian, A. A. – Frequencies of Superflares in Solar-Type Stars Detected by the Kepler Orbital Observatory // *Astrophysics, Volume 56, Issue 4, pp. 488-500, 12/2013.*

Gyulbudaghian, A. L.; Mendez, R. A. – Unstable Objects in Molecular Cloud LDN133 // *Astrophysics, Volume 56, Issue 4, pp. 531-538, 12/2013.*

Nikoghossian, A. G. – Role of the Reflection Function in Describing the Diffusion of Radiation in Plane-Parallel Inhomogeneous Atmospheres // *Astrophysics, Volume 56, Issue 4, pp. 553-560, 12/2013.*

Moraux, E.; Artemenko, S.; Bouvier, J.; Irwin, J.; Ibrahimov, M.; **Magakian, T.**; Grankin, K.; **Nikogossian, E.**; Cardoso, C.; Hodgkin, S.; Aigrain, S.; **Movsessian, T. A.** – The Monitor Project: stellar rotation at 13 Myr. I. A photometric monitoring survey of the young open cluster h Persei // *Astronomy & Astrophysics, Volume 560, id.A13, 25 pp., 12/2013.*

Ter-Kazarian, G.; **Sargsyan, L.** – Signature of Plausible Accreting Supermassive Black Holes in Mrk 261/262 and Mrk 266 // *Advances in Astronomy, vol. 2013, id.710906, 00/2013.*

Proceedings papers

Hakobyan, A. A.; **Petrosian, A. R.**; Mamon, G. A.; McLean, B.; Kunth, D.; Turatto, M.; Cappellaro, E.; Mannucci, F.; Allen, R. J.; Panagia, N.; Della Valle, M.; Petrosyan, G. V. – Five Supernova Survey Galaxies in the Southern Hemisphere: Supernova Ia Rates // *Binary Paths to Type Ia Supernovae Explosions, Proc. IAU Symposium, Volume 281, pp. 24-25, 01/2013.*

Mickaelian, A. M.; **Sinamyan, P. K.** – The sample of FBS cataclysmic variables // *Feeding Compact Objects: Accretion on All Scales, Proc. IAU Symposium, Volume 290, pp. 275-276, 02/2013.*

Mickaelian, A. M.; **Harutyunyan, G. S.** – Study of the Byurakan-IRAS galaxy sample // *, Proc. IAU Symposium, Volume 292, pp. 159, 03/2013.*

Mickaelian, A. M.; **Harutyunyan, G. S.** – Byurakan-IRAS galaxies as massive galaxies with nuclear and starburst activity // *The Intriguing Life of Massive Galaxies, Proc. IAU Symposium, Volume 295, pp. 182, 07/2013.*

Arshakian, T.; Ossenkopf, V. – Wavelet-based cross-correlation analysis of the scaling in molecular clouds // *Protostars and Planets VI, Heidelberg, July 15-20, 2013. Poster #1B017, 07/2013.*

Movsessian, T.; **Magakian, T.**; Moiseev, A. – Two Epoch Fabry-Perot Observations of FS Tau B // *Protostars and Planets VI, Heidelberg, July 15-20, 2013. Poster #1K038, 07/2013.*

Ghazaryan, S. – Physical properties of HgMn stars on the basis of the available data // *EAS Publications Series, Volume 63, 2013, pp. 411-413, 12/2013.*

Other papers

Ter-Kazarian, G. – Is there an inertia due to the supersymmetry // *eprint arXiv:1303.3180, 03/2013.*

Ter-Kazarian, G. – Classical analog of extended phase space SUSY and its breaking // *eprint arXiv:1306.2271, 06/2013.*

Editing of books, etc.

Mickaelian, A.M. – Beniamin Markarian // *Edit Print, Yerevan, 28 pp., 10/2013.*

Most productive authors have been *(3 and more refereed papers):*

Authors	Ref. papers	Proc. papers	Other publ.-s	All public.-s
Abrahamyan H.V.	3	-	-	3
Hakobyan A.A.	3	1	-	4
Nikogossian E.H.	4	-	-	4
Paronyan G.M.	3	-	-	3
Yeghikian Ar.G.	3	-	-	3

Publications by research groups:

Head of the group	Ref. papers	Proc. papers	Other publ.-s	All public.-s
Harutyunian H.A.	3	1	-	4
Magakian T.Yu.	4	1	-	5
Melikian N.D.	1	-	-	1
Mickaelian A.M.	3	3	1	7
Parsamian E.S.	6	-	-	6
Petrosian A.R.	3	1	-	4

Isaac Newton Institute (INI) Armenian Branch

The President of the Isaac Newton Institute of Chile ***Dr.*** **Gonzalo Alcaino** established the INI Armenian Branch in 2000. ***Dr.*** **A.M. Mickaelian** is its Resident Director. Altogether in 2013, 7 papers were published in AJ, ApJ, A&A, and MNRAS, including 4 in frame of INI (listed in *"Publications"*). The research staff (26): H.V. Abrahamian, L.S. Aramyan, T.G. Arshakian, M.G. Avtandilyan, S.K. Balayan, L.K. Erastova, K.S. Gigoyan, A.L. Gyulbudaghian, A.A. Hakobyan, S.A. Hakopian, H.A. Harutyunian, L.R. Hovhannisyan, R.A. Kandalyan, A.A. Karapetian, T.Yu. Magakian, N.D. Melikian, A.M. Mickaelian, G.A. Mikayelyan, H.Kh. Navasardian, T.A. Nazaryan, A.G. Nikoghossian, E.H. Nikoghossian, A.R. Petrosian, L.A. Sargsyan, P.K. Sinamyan, A.A. Sinanian.

Teaching, supervision of students

Following Byurakan scientists teach astrophysical subjects at the YSU Department of Physics, Chair of General Physics and Astrophysics: A.A. Akopian, H.A. Harutyunian, T.H. Movsessian, A.G. Nikoghossian, A.G. Yeghikyan. ***Prof.*** **Davit Sedrakian** was the head of the Chair of General Physics and Astrophysics until the end of 2013.

Byurakan scientists have also been supervisors of B.Sc. and M.Sc. Diploma theses at the YSU.

Two Byurakan astronomers defended their PhD theses in 2013: **Marietta Gyulzadyan** (supervisor: A.R. Petrosian) in Byurakan and **Satenik Ghazaryan** (supervisors: Haik Harutyunian and Georges Alecian) in Paris. At present BAO has two Ph.D. students. **Tigran Nazaryan** and **Levon Aramyan** (supervisor: A.R. Petrosian). In addition, a few other Byurakan fellows are in the stage of preparation of their Ph.D. theses: N.S. Asatrian, A.G. Eghikian, A.A. Karapetian, H.V. Abrahamyan and G.M. Paronyan.

The International Astronomical Olympiad (IAO) was held in 2013 in Dubingay, Lithuania, where the Armenian pupils won 4 Third-rank Diploma (teachers: Marietta Gyulzadian and Tigran Nazaryan). In addition, the Armenian team for the first time participated in the 7th **International Olympiad on Astronomy and Astrophysics (IOAA)** in Volos, Greece.

Membership

International Astronomical Union (IAU, 15 members): K.S. Gigoyan, A.L. Gyulbudaghian, S.A. Hakopian, H.A. Harutyunian, A.T. Kalloghlian, E.Ye. Khachikian, T.Yu. Magakian, A.P. Mahtessian, N.D. Melikian, A.M. Mickaelian, A.G. Nikoghossian, E.H. Nikogossian, E.S. Parsamian, A.R. Petrosian, H.V. Pikichian.

European Astronomical Society (EAS, 18 members): A.S. Amirkhanian, R.R. Andreasyan, K.S. Gigoyan, A.A. Hakobyan, H.A. Harutyunian, M.A. Hovhannissian, S.G. Iskudarian, E.Ye. Khachikian, T.Yu. Magakian, V.H. Malumian, N.D. Melikian, A.M. Mickaelian, T.H. Movsessian, E.H. Nikogossian, E.S. Parsamian, A.R. Petrosian, H.V. Pikichian, A.G. Yeghikian.

Euro-Asian Astronomical Society (EAAS, 7 members): T.Yu. Magakian, N.D. Melikian, A.M. Mickaelian, A.G. Nikoghossian, G.B. Ohanian, E.S. Parsamian, A.R. Petrosian.
American Astronomical Society (AAS, 1 member): A.M. Mickaelian.
Armenian Astronomical Society (ArAS): 40 members from BAO.

International Committees and Working Groups (WG)

EAAS Executive Council: A.M. Mickaelian
EAAS Scientific-Technical Committee: T.Yu. Magakian
EAAS International Bureau: A.M. Mickaelian
IAU Commission 5 WG on Astronomical Data (WGAD): A.M. Mickaelian
IAU Commission 5 WG on Preservation and Digitization of Photographic Plates (PDPP): A.M. Mickaelian
IAU Commission 41 WG on Astronomy and World Heritage (WGAWH): A.M. Mickaelian
IAU Commission 46 "Astronomy Education & Development": H.A. Harutyunian (Liaison in Armenia)
International Centre for Relativistic Astrophysics (ICRANet) Director's Council: H.A. Harutyunian
International Virtual Observatory Alliance (IVOA) Executive Committee: A.M. Mickaelian
International Planetary Data Alliance (IPDA): A.M. Mickaelian
Large Telescopes Thematic Committee (KTBT): E.Ye. Khachikian
Sub-Regional European Astronomical Committee (SREAC): A.M. Mickaelian

Journal *Astrofizika/Astrophysics*

The journal *Astrofizika* (English translation: *Astrophysics*) is being published by the Armenian NAS. Five Byurakan astronomers are involved in the Editorial Board of *Astrofizika* (Editor-in-Chief: *Prof.* Davit Sedrakian from the YSU): **E.Ye. Khachikian** (*Deputy Editor-in-Chief*), **A.T. Kalloghlian** (*Secretary-in-Chief*), **H.A. Harutyunian**, **A.G. Nikoghossian**, and **E.S. Parsamian**. Four issues of Vol. 56 were published in 2013 with 48 papers, including 17 (35.4%) from BAO (compared to 17 out of 52 (32.7%) in 2012, 21 out of 56 (37.5%) in 2011 and 20 out of 57 (35%) in 2010). Other papers were from the YSU, other Armenian institutions, Russia, Ukraine, etc.

Armenian Astronomical Society (ArAS)

ArAS was created in 1999-2001 and at present is an active organization supporting astronomy/astrophysics and science in general in Armenia. Co-Presidents: **H.A. Harutyunian**, **A.M. Mickaelian**, **Ye.Terzian** (Cornell Univ, USA), Vice-President: **T.Yu. Magakian**, Secretary: **E.H. Nikoghossian**, Treasurer: **M.V. Gyulzadyan**, Webmaster: **G.A. Mikayelyan**. ArAS has **95 members from 21 countries**, including 56 from Armenia. During 2013, the **ArAS webpage** was updated, eight issues (Nos. 61-68) of the **ArAS Newsletter (ArASNews)** were released, **ArAS XII meeting** was held on December 27, **ArAS Annual prize for Young Astronomers** was awarded for the 10th time (2013 winners: Hayk Abrahamyan and Avet Harutyunyan). During 2013, in frame of the **scientific journalism**, ArAS prepared and circulated some 100 press-releases to Armenian mass media with information on sky events, international and local astronomical news that resulted in some 700 publications.