

# ArAS News

NEWSLETTER OF THE  
ARMENIAN ASTRONOMICAL SOCIETY (ArAS)



**No. 77** (31 January 2015)

---

Editor: Sona FARMANYAN

ArAS Newsletter online at: <http://www.aras.am/ArasNews/arasnews.html>

---

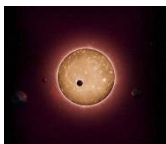
# CONTENTS



**1 CHANGE OF ARASNEWS EDITOR 3**



**2 BYURAKAN ASTROPHYSICAL OBSERVATORY IN 2014: ANNUAL REPORT 4-34**



**3 VARDAN ADIBEKYAN IN THE TEAM DISCOVERING KEPLER 444 FIVE PLANETS 35-36**



**4 ASTRONOMICAL CONFERENCE IN SHARJAH, UAE 36**



**5 WORKSHOP "GALAXIES INSIDE AND OUT" IN TEHRAN, IRAN 37**



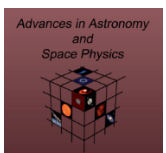
**6 YOUNG SCIENTISTS' CONFERENCE IN KIEV, UKRAINE 38**



**7 ASTRONOMERS AMONG NAS RA NEW FOREIGN MEMBERS 39**



**8 ANSEF GRANT WINNERS 2015 40**



**9 JOURNAL "ADVANCES IN ASTRONOMY AND SPACE PHYSICS" 41**



**10 ELMA PARSAMYAN IN CONVERSATION WITH BO REIPURTH 42-45**



**11 ANNIVERSARIES: SMBAT BALAYAN - 50 44**



**12 MONTHLY CALENDAR OF ASTRONOMICAL EVENTS: FEBRUARY 2015 44**

## CHANGE of ArASNews EDITOR

In 2015, ArAS is going to significantly renovate its [Electronic Newsletter \(ArASNews\)](#) with a number of novelties:

- we will have a **new Editor, Sona Farmanyan,**
- our **mailing list will be revised and updated** with more organizations and societies addresses,
- the Newsletter will have a **new design,**
- the periodicity has been changed to **12 issues annually,** 1 issue at the end of each month; this will make ArASNews more operative,
- **more news and more articles** will be released, typically 3-5 articles per issue,
- we will have **permanent sections,** such as *BAO News, Research Articles, Scientific Meetings, Awards, Archaeoastronomy, Astronomical Education, Release of other newsletters, Publication of Books, Anniversaries, Forthcoming Events, etc.,*
- we will encourage more **science articles, typically review articles on research projects,** etc.,
- [ArASNews Reference List](#) at ArAS webpage will be updated with access to all previous articles,
- it will be possible to **subscribe to ArASNews through its webpage.**

We are pleased to introduce **Sona Farmanyan** as the new Editor of ArASNews starting with this issue (#77). Already in 2013-2014, she helped a lot in preparation and release of our Newsletters and [ArAS press-releases distributed to Armenian mass-media](#), and she has enough experience for further successful work. In addition, she is an expert in English and Cultural Studies and she is interested in **Astronomy in Culture**, which could be one of ArAS new areas of activities, together with Archaeoastronomy, Amateur Astronomy, Astronomical Education and Public Outreach. Sona has graduated from [Yerevan State University \(YSU\)](#) and received her M.Sc. degree in 2014. Since 2013, she works at NAS RA [Viktor Ambartsumian International Science Prize](#) office as Executive Secretary of the International Steering Committee and since 2014 she also is the program coordinator of [“Viktor Ambartsumian Descendants” Educational Charitable Foundation](#). In 2013 she was the leader of the LOC supporting team at [IAU Symposium #304](#). In 2014 she was the coordinator of the [Meeting “Relation of Astronomy to other Sciences, Culture and Society”](#), [Byurakan Science Camp \(BSC\)](#), ArAS School Lectures program and many events organized in Byurakan. In the proceedings of astronomical meetings, Sona has published several papers related to Astronomy in Culture. She has been the language editor of several astronomical publications. Sona created a [Junior Astronomers Club \(JAC\)](#) to increase young people’s interest to astronomy. She is a member of [IAU Working Group on Archaeoastronomy and Astronomy in Culture \(WGAAC\)](#).

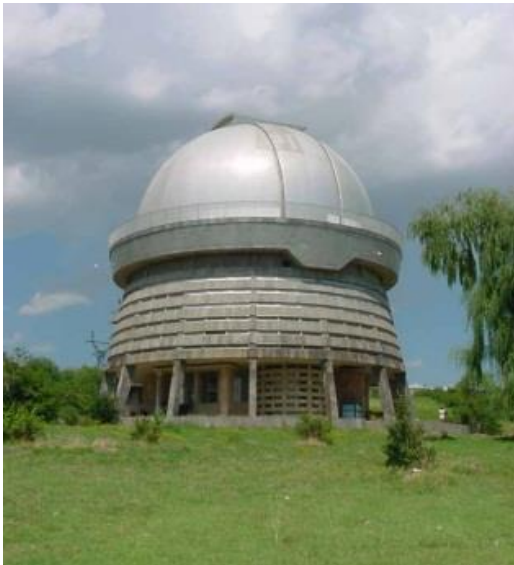
We would like to thank all **previous ArASNews Editors** as well:

Editors	Years	Issues
Tigran Magakian	2002-2004	1-12
Lusine Sargsyan	2005	13-16
Lilit Hovhannisyan	2006-2007	17-24
Areg Mickaelian	2008-2014	25-76

*Haik Harutyunian and Areg Mickaelian, ArAS Co-Presidents*

# BYURAKAN ASTROPHYSICAL OBSERVATORY in 2014: ANNUAL REPORT

## Introduction



In 2014, Byurakan astronomers continued and developed 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. BAO scientists had 2 ANSEF grants in 2014, as well as a French-Armenian (CNRS-SCS) joint project for 2014-2015. 4 BAO astronomers were listed among the most productive scientists in Armenia. There have been **27 publications in refereed journals**, including most important international ones (*ApJ*, *A&A*, *MNRAS*) and 35 papers in proceedings of meetings, including the Proceedings of IAU Symposium #304 held in 2013 in Armenia. There were **36 missions** for research and participation in meetings and schools.

One of the most important events was the creation of **BAO International Science Advisory Committee (ISAC)** in May 2014 by NAS RA. It involved Yervant Terzian (USA, Chair), Felix Aharonian (Ireland/Germany), Yuri Balega (Russia), Jacques Boulesteix (France), Daniel Kunth (France), Michel Mayor (Switzerland), Massimo Turatto (Italy), and Robert Williams (USA). On 24-27 June BAO ISAC had its first visit to Armenia and later on submitted its report to NAS RA President *Prof. Radik Martirosyan* for further improvement of BAO organization and management.

Another important event was **BAO research staff members Attestation** in January; Attestation Committee members: Artur Nikoghossian (Chair), Norair Melikian, Areg Mickaelian, Elena Nikoghosyan, and Artashes Petrosian. Some positions were revised and new salaries were based on these revisions. **BAO annual summarizing meeting** was held on Dec 15, where the Director Haik Harutyunian reported 2014 results.

## 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 **Ministry of Education and Science (MES) State Committee for Science (SCS)** through Basic Program called "*Evolution of Cosmic Objects through their Activity*". All researchers and the technical and administrative services, altogether 95 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, Elena Nikoghosyan, Elma Parsamian, and Artashes Petrosian. Altogether 44 scientists work in these groups. Three groups have been 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 till June 2014 (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 2014, the project of reconstruction of BAO **2.6m telescope** was continued. During the last years, this telescope is the only one providing scientific results. Now new equipment is to be installed for science observations. Some works have been carried out also on **1m Schmidt telescope**. Having new focal system, this telescope may carry out new tasks.

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 37,500 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 2014, the abstracts of published papers are given.

### *Stars and Nebulae (14)*

#### *Spectra of Stellar Flares. Continuum Emission*

**Melikian, N. D.** (Ap 57, 77, 2014)

Spectral studies of stellar flares are discussed in this article. It is shown that at least during strong flares the continuum emission plays a vital role, especially in the blue part of the spectrum. This may explain the fact that the H $\beta$  emission line is suppressed much more strongly than the H $\alpha$  line during flare maxima. The distribution of the flare energy in the 4600-7200 Å range is obtained during a flare of the star WX UMa. The delays in the maximum values of the equivalent widths of the emission lines relative to the flare maximum are also obtained, as well as the increase in these lines to a maximum when the star is in a quiescent state. While the post-maximum evolution of the equivalent widths can be explained by recombination emission in lines, the pre-flare increase in the line intensities remains incomprehensible. Slow and flare-like variations in the emission lines are also recorded. The spectral classes of three Orion flare stars are determined.

### ***New H $\alpha$ Emission Stars in Cep OB3 Region. A Rapid Brightness Variation of V 733 Cep***

**Melikian, N. D.; Gomez, J.; Karapetian, A. A.** (Ap 57, 500, 2014)

A search of emission stars has been done on the basis of digitized photographic plates received with the 40" Schmidt telescope of Byurakan Observatory equipped with a 4° objective prism. Forty-six new emission stars are found in a small area around the known FU Ori type variable V 733 Cep. Emission stars on the J-H – H-K diagram are situated on or in the neighborhood of T Tau locus. V, R, I photometry for some of the emission stars is performed as well. Three new variable stars are found in the region. A rapid brightness variation is detected on V 733 Cep.

### ***The Star-Formation Region SNO 87***

**Gyulbudaghian, A. L.** (Ap 57, 213, 2014)

The star-formation region SNO 87 is associated with the dark cloud LDN 212. <sup>12</sup>CO(1-0) observations of a part of the molecular cloud associated with SNO 87 show that it lies somewhat to the north of the densest part of the molecular cloud. There is a bipolar molecular outflow from SNO 87, both branches of which are blue, i.e., the velocity is directed toward us with a velocity of ~3.5 km/s relative to the cloud. <sup>12</sup>CO(1-0) observations of a part of the cloud lying to the E of SNO 87 show that this part of the cloud rotates with an angular velocity  $\Omega = 2.44 \cdot 10^{-14} \text{ s}^{-1}$ . SNO 87 contains several stars that are coupled with nebular filaments, bursts, and Herbig-Haro objects. It is also associated with the point source IRAS 18064-2413.

### ***New Radial Systems of Dark Globules and HH Objects***

**Gyulbudaghian, A. L.; Mendez, R. A.** (Ap 57, 520, 2014)

During survey of ESO/SRC plates of the Southern Hemisphere, we have found several dozen new HH objects, star-forming regions, and cometary nebulae [1]. There are also radial systems of dark globules in the vicinity of these new objects. Several regions, containing some of these objects, were observed on the 1.54 m telescope with several narrow band filters. In this paper we present the results of observations of two new radial systems of dark globules and several HH objects and also the results of <sup>12</sup>CO(1-0) observations of the dark cloud, part of which is rotating with angular velocity  $\Omega = 4.3 \cdot 10^{-14} \text{ s}^{-1}$ .

### ***HH 1050: A Bipolar Flow in the Cloud L 988***

**Movsessian, T. A.; Magakian, T. Yu.** (Ap 57, 231, 2014)

The optical collimated flow HH 1050 (L 988a) is studied. Observations with the 2.6-m telescope and data from catalogs and surveys, including the archive of the Hubble telescope, are used to examine its morphology and to confirm the bipolar nature of the flow with spectral data. The distinctive feature of the flow HH 1050 is that it propagates within a wide cone with an aperture angle of about 30-40° and contains both moving condensations and shocked cloudlets. The source of the flow is one of the components of the binary star IRAS 21007+4951 (WISE J210222.70+500308.3). Other young stars in this region are also discussed.

### ***Young Stellar Cluster in the Vicinity of the IRAS 05137+3919 Source***

**Nikoghosyan, E. H.; Azatyan, N.** (Ap 57, 330, 2014)

84 PMS stellar objects are identified in a cluster located in the vicinity of IRAS 05137+3919 using the UKIDSS data base and Spitzer telescope (IRAC) images. The age of the cluster is 1.5-2.0 million years. Young stars are distributed nonuniformly in the cluster and form two subgroups. One is localized around the YSO CPM, which is a binary star, and the second contains a substantial number of objects with early spectral classes surrounded by gas-dust nebulae. The K luminosity functions of the PMS stars indicate that the cluster is at a distance of ~4.5 kpc. One of the components of CPM 15 appears to have Sp B3-B5 and is an Ae/Be Herbig star.

### ***Cool carbon stars in the halo and in dwarf galaxies: H $\alpha$ , colours, and variability***

**Mauron, N.; Gigoyan, K. S.; Berlioz-Arthaud, P.; Klotz, A.** (A&A 562, id.A24, 2014)

The population of cool carbon (C) stars located far from the galactic plane is probably made of debris of small galaxies such as the <ASTROBJ>Sagittarius dwarf spheroidal galaxy (Sgr), which are disrupted by the gravitational field of the Galaxy. We aim to know this population better through spectroscopy, 2MASS photometric colours, and variability data. When possible, we compared the halo results to C star populations in the Fornax dwarf spheroidal galaxy, Sgr, and the solar neighbourhood. We first present a few new discoveries of C stars in the halo and in Fornax. The number of spectra of halo C stars is now 125. Forty percent show H $\alpha$  in emission. The narrow location in the JHK diagram of the halo C stars is found to differ from that of similar C stars in the above galaxies. The light curves of the Catalina and LINEAR

variability databases were exploited to derive the pulsation periods of 66 halo C stars. A few supplementary periods were obtained with the TAROT telescopes. We confirm that the period distribution of the halo strongly resembles that of Fornax, and we found that it is very different from the C stars in the solar neighbourhood. There is a larger proportion of short-period Mira/SRa variables in the halo than in Sgr, but the survey for C stars in this dwarf galaxy is not complete, and the study of their variability needs to be continued to investigate the link between Sgr and the cool halo C stars. Based on observations made with the NTT and 3.6 m telescope at the European Southern Observatory (La Silla, Chile; programs 084.D-0302 and 070.D-0203), with the TAROT telescopes at La Silla and at Observatoire de la Côte d'Azur (France), and on the exploitation of the Catalina Sky Survey and the LINEAR variability databases. Appendix A is available in electronic form at <http://www.aanda.org>

### ***Cool carbon stars in the halo and Fornax dSph***

Mauron, N.; **Gigoyan, K. S.**; Berlioz-Arthaud, P.; Klotz, A. (VizieR On-line Data Catalog: J/A+A/562/A24. Originally published in: 2014A&A...562A..24M)

Spectroscopy of halo candidate C stars was achieved at ESO (La Silla) on 17-18 October 2009 at the NTT telescope equipped with the EFOSC2 instrument in the spectral range 5200-9300Å. We were able to secure the spectra of 25 candidates with exposure times of generally a few minutes, and eventually, eight were found to be C-rich. We also observed three carbon stars in the Carina dwarf galaxy because they were erroneously believed to be in the halo, and for comparison APM 2225-1401, a C star from the list of Totten and Irwin (1998MNRAS.294....1T). We found spectra that covered the H $\alpha$  region for four halo stars in the Byurakan Astrophysical Observatory archive. They were obtained with the BAO 2.6m telescope and the ByuFOSC2 spectrograph. These spectra were taken on 28 March 1999, 12 June 2002, 11 May 2000, and 11 June 2000 with a resolution  $\sim 8\text{\AA}$ . Concerning Fornax, spectra of C stars were found in the ESO Archive (program 70.D-0203, P.I. Marc Azzopardi). They were obtained on 5 November 2002 with the ESO 3.6m telescope and the EFOSC instrument with a resolution  $\sim 23\text{\AA}$  and a spectral coverage from 4000Å to 7950Å. Sixteen C stars were monitored with the ground-based 25cm diameter TAROT telescopes. This monitoring took place irregularly at ESO La Silla and Observatoire de la Cote d'Azur (France) beginning in 2010. Thanks to the recently released Catalina and LINEAR databases, we were able to examine the light curves of 143 halo C stars and found 66 new periodic (Mira or SRa-type) variables among them.

### ***Investigation of Faint Galactic Carbon Stars from the First Byurakan Spectral sky Survey. Optical Variability. I. N-Type AGB Carbon Stars. K-band Absolute Magnitudes and Distances***

**Gigoyan, K. S.**; ...; **Kostandyan, G.**; ...; **Abrahamyan, H. V.**; **Paronyan, G. M.** (Ap 57, 510, 2014)

The goal of this paper is to present an optical variability study of the comparatively faint carbon (C) stars which have been discovered by searching the First Byurakan Survey (FBS) low-resolution (lr) spectral plates at high Galactic latitudes using recent wide-area variability databases. The light curves from the Catalina Sky Survey (CSS) and Northern Sky Variability Survey (NSVS) databases were exploited to study their variability nature. In this paper, first in this series, the variability classes are presented for 54 N-type Asymptotic Giant Branch (AGB) C stars. One finds that 9 stars belongs to the group of Mira-type, 43 are Semi-Regular (SR), and 2 stars are Irregular (Irr)-type variables. The variability types of 27 objects has been established for the first time. K-band absolute magnitudes, distances, and height from the Galactic plane were estimated for all of them. We aim to better understand the nature of the selected C stars through spectroscopy, 2MASS photometric colors, and variability data. Most of the tools used in this study are developed within the framework of the Astronomical Virtual Observatory.

### ***AGB stars and the plate archives heritage***

Nesci, R.; ...; **Gigoyan, K.**; Mauron, N. (Proc. Astroplate2014, p. 91, 2014)

We report on the characterization of a number of AGB candidate stars identified with objective-prism plates of the Byurakan Observatory. Digitized photographic sky survey plates and recent CCD photometry have been used to improve the selection and distinguish variable and non-variable stars. Some comparisons among published catalog magnitudes are also made. Slit spectroscopy from the Asiago and Loiano Observatories allowed a firm spectral classification, separating C-Type, N-Type and normal M giants. Color-color plots using WISE, AKARI and 2MASS J-band data allow an efficient discrimination of spectral types, which can be used for the definition of larger statistical samples.

### ***A search for pulsations in the HgMn star HD 45975 with CoRoT photometry and ground-based spectroscopy***

Morel, T.; ...; Alecian, G.; **Ghazaryan, S.**; et al. (A&A 561, id.A35, 2014)

The existence of pulsations in HgMn stars is still being debated. To provide the first unambiguous observational detection of pulsations in this class of chemically peculiar objects, the bright star HD 45975 was monitored for nearly two months by the CoRoT satellite. Independent analyses of the light curve provide evidence of monophasic variations with a frequency of  $0.7572 \text{ d}^{-1}$  and a peak-to-peak amplitude of  $\sim 2800$  ppm. Multisite, ground-based spectroscopic observations overlapping the CoRoT observations show the star to be a long-period, single-lined binary. Furthermore, with the notable exception of mercury, they reveal the same periodicity as in photometry in the line moments of chemical species exhibiting strong overabundances (e.g., Mn and Y). In contrast, lines of other elements do not show significant variations. As found in other HgMn stars, the pattern of variability consists in an absorption bump moving redwards across the line profiles. We argue that the photometric and spectroscopic changes are more consistent with an interpretation in terms of rotational modulation of spots at the stellar surface. In this framework, the existence of pulsations producing photometric variations above the  $\sim 50$  ppm level is unlikely in HD 45975. This provides strong constraints on the excitation/damping of pulsation modes in this HgMn star. The CoRoT space mission was developed and is operated by the French space agency CNES, with participation of ESA's RSSD and Science Programmes, Austria, Belgium, Brazil, Germany, and Spain. This work is based on observations collected at La Silla and Paranal Observatories, ESO (Chile), with the HARPS and UVES spectrographs at the 3.6-m and very large telescopes, under programmes LP185.D-0056 and 287.D-5066. It is also based on observations made with the Mercator Telescope, operated on the island of La Palma by the Flemish Community, at the Spanish Observatorio del Roque de los Muchachos of the Instituto de Astrofísica de Canarias. Based on observations obtained with the HERMES spectrograph, which is supported by the Fund for Scientific Research of Flanders (FWO), Belgium, the Research Council of K.U. Leuven, Belgium, the Fonds National de la Recherche Scientifique (FNRS), Belgium, the Royal Observatory of Belgium, the Observatoire de Genève, Switzerland, and the Thüringer Landessternwarte Tautenburg, Germany.

### ***Physical and Chemical Parameters of HgMn Stars Based on Available Data***

**Ghazaryan, S.** (Ap 57, 159, 2014)

### ***Searching for solar siblings among the HARPS data***

Batista, S. F. A.; Adibekyan, V. Zh.; ...; **Hakobyan, A. A.** (A&A 564, id.A43, 2014)

The search for solar siblings has been particularly fruitful in the past few years. At present, there are four plausible candidates reported in the literature: HIP21158, HIP87382, HIP47399, and HIP92831. In this study we conduct a search for solar siblings among the HARPS high-resolution FGK dwarfs sample, which includes precise chemical abundances and kinematics for 1111 stars. Using a new approach based on chemical abundance trends with condensation temperature, kinematics, and ages we found one (additional) potential solar sibling candidate: HIP97507. Based on observations collected at the La Silla Paranal Observatory, ESO (Chile) with the HARPS spectrograph at the 3.6-m telescope (ESO runs ID 72.C-0488, 082.C-0212, and 085.C-0063).

### ***GRB 140818B: ISON-Kislovodsk and ISON-Burakan optical upper limit.***

Pozanenko, A.; ...; **Ohanian, G.**; **Andreasyan, H.**; et al. (GRB Coordinates Network, Circular Service, 16728, 1, 2014)

## ***Extragalactic Astronomy (36)***

### ***The Second Byurakan Survey Galaxies in Close Pairs***

**Nazaryan, T. A.** (Ap 57, 50, 2014)

418 pairs containing galaxies from the Second Byurakan Survey (SBS) with  $dV < 800 \text{ km/s}$  and  $D_p < 100 \text{ kpc}$  are selected for study of the dependence of star formation rates and nuclear activity on the kinematics of the pairs and on the morphologies and masses of the paired galaxies. The following basic results are obtained: SBS galaxies with neighbors do not differ spectral type from isolated SBS galaxies. The SBS galaxies are brighter than their neighbors by  $0^m.5$  on the average, but there is no statistically significant difference in their colors, morphologies, and star formation rates. There is a weak, but statistically significant correlation between the morphologies of the paired galaxies. The neighbors of the SBS galaxies have a lower fraction of star forming galaxies and a higher fraction of galaxies in all the other spectral types. The specific (relative) star formation rate (SSFR) is higher for galaxies that are closer to a neighboring galaxy for galaxies



of all morphological types. The enhancement is the greatest for galaxies of earlier types (by 1 dex) and less for galaxies of later morphological types. There is an increase of SSFR of galaxies within all ranges of masses. Both major and minor interactions can increase the SSFR by 0.7 dex, but the effect is greater for major interactions, while in the case of minor interactions the SSFR increases only in the massive members of the pairs. The existence of neighbor galaxy of earlier morphological types does not enhance the SSFR, neighbor galaxies of the same morphological types produce a moderate increase in the SSFR, while neighboring galaxies of later morphological types cause a significant increase in the SSFR.

### ***Close Neighbors of Markarian Galaxies. II. Statistics and Discussions***

**Nazaryan, T. A.; Petrosian, A. R.; Hakobyan, A. A.;** et al. (Ap 57, 14, 2014)

According to the database from the first paper, we selected 180 pairs with  $dV < 800 \text{ km s}^{-1}$  and  $D_p < 60 \text{ kpc}$  containing Markarian (MRK) galaxies. We studied the dependence of galaxies' integral parameters, star-formation (SF), and active galactic nuclei (AGN) properties on kinematics of pairs, their structure, and large-scale environments. The following main results were obtained: projected radial separation  $D_p$  between galaxies correlates with the perturbation level  $P$  of the pairs. Both parameters do not correlate with line-of-sight velocity difference  $dV$  of galaxies.  $D_p$  and  $P$  are better measures of interaction strength than  $dV$ . The latter correlates with the density of large-scale environment and with the morphologies of galaxies. Both galaxies in a pair are of the same nature; the only difference is that MRK galaxies are usually brighter than their neighbors on average by 0.9 mag. Specific star formation rates (SSFR) of galaxies in pairs with smaller  $D_p$  or  $dV$  is on average 0.5 dex higher than that of galaxies in pairs with larger  $D_p$  or  $dV$ . Closeness of a neighbor with the same and later morphological type increases the SSFR, while earlier-type neighbors do not increase SSFR. Major interactions/mergers trigger SF and AGN more effectively than minor ones. The fraction of AGNs is higher in more perturbed pairs and pairs with smaller  $D_p$ . AGNs typically are in stronger interacting systems than star-forming and passive galaxies. There are correlations of both SSFRs and spectral properties of nuclei between pair members.

### ***Close pairs of galaxies with different activity levels***

**Nazaryan, T. A.; Petrosian, A. R.; Hakobyan, A. A.;** et al. (Proc. IAU S304, 327, 2014)

We selected and studied 180 pairs with  $dV < 800 \text{ km s}^{-1}$  and  $D_p < 60 \text{ kpc}$  containing Markarian (MRK) galaxies to investigate the dependence of galaxies integral parameters, star-formation (SF) and active galactic nuclei (AGN) properties on kinematics of pairs, their structure and large-scale environments. Projected radial separation  $D_p$  and perturbation level  $P$  are better measures of interaction strength than  $dV$ . The latter correlates with the density of large-scale environment and with the morphologies of galaxies. Both galaxies in a pair are of the same nature, the only difference is that MRK galaxies are usually brighter than their neighbors. Specific star formation rates (SSFR) of galaxies in pairs with smaller  $D_p$  or  $dV$  is in average 0.5 dex higher than that of galaxies in pairs with larger  $D_p$  or  $dV$ . Closeness of a neighbor with the same and later morphological type increases the SSFR, while earlier-type neighbors do not increase SSFR. Major interactions/mergers trigger SF and AGN more effectively than minor ones. The fraction of AGNs is higher in more perturbed pairs and pairs with smaller  $D_p$ . AGNs typically are in stronger interacting systems than star-forming and passive galaxies. There are correlations of both SSFRs and spectral properties of nuclei between pair members.

### ***Supernovae and their host galaxies - II. The relative frequencies of supernovae types in spirals***

**Hakobyan, A. A.; Nazaryan, T. A.;** Adibekyan, V. Zh.; **Petrosian, A. R.; Aramyan, L. S.;** et al. (MNRAS 444, 2428, 2014)

We present an analysis of the relative frequencies of different supernova (SN) types in spirals with various morphologies and in barred or unbarred galaxies. We use a well-defined and homogeneous sample of spiral host galaxies of 692 SNe from the Sloan Digital Sky Survey in different stages of galaxy-galaxy interaction and activity classes of nucleus. We propose that the underlying mechanisms shaping the number ratios of SNe types can be interpreted within the framework of interaction-induced star formation, in addition to the known relations between morphologies and stellar populations. We find a strong trend in behaviour of the  $N_{Ia}/N_{CC}$  ratio depending on host morphology, such that early spirals include more Type Ia SNe. The  $N_{Ibc}/N_{II}$  ratio is higher in a broad bin of early-type hosts. The  $N_{Ia}/N_{CC}$  ratio is nearly constant when changing from normal, perturbed to interacting galaxies, then declines in merging galaxies, whereas it jumps to the highest value in post-merging/remnant galaxies. In contrast, the  $N_{Ibc}/N_{II}$  ratio jumps to the highest value in merging galaxies and slightly declines in post-merging/remnant subsample. The interpretation is that the star formation rates and morphologies of galaxies, which are strongly affected in the final stages of interaction, have an impact on the number ratios of SNe types. The  $N_{Ia}/N_{CC}$  ( $N_{Ibc}/N_{II}$ ) ratio increases (decreases) from star-forming to active galactic nuclei (AGN) classes of galaxies. These variations are consistent with the scenario of an interaction-triggered starburst evolving into AGN during the later stages of interaction, accompanied with the change of star formation and transformation of the galaxy morphology into an earlier type.

### ***Supernovae in paired galaxies***

**Nazaryan, T. A.; Petrosian, A. R.; Hakobyan, A. A.;** Adibekyan, V. Zh.; ...; **Aramyan, L. S.** (Proc. IAU S304, 351, 2014)

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 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.

### ***Relative frequencies of supernovae versus properties of spiral hosts***

**Hakobyan, A. A.; Nazaryan, T. A.;** Adibekyan, V. Zh.; **Petrosian, A. R.; Aramyan, L. S.;** et al. (Proc. IAU S304, 339, 2014)

In this work, we present an analysis of SNe number ratios in spiral galaxies with different morphological subtypes, luminosities, sSFR, and metallicities, to provide important information about the physical properties of the progenitor populations.

### ***Markarian survey and Markarian galaxies***

**Mickaelian, A. M.** (Proc. IAU S304, 1, 2014)

Markarian survey (or the First Byurakan Survey, FBS) was the first systematic survey for active galaxies and was a new method for search for such objects. Until now, it is the largest objective prism survey of the sky (17,000 deg<sup>2</sup>). It was carried out in 1965-1980 by B. E. Markarian and his colleagues and resulted in discovery of 1517 UV-excess (Markarian) galaxies. They contain many active galaxies, as well as powerful gamma-, X-ray, IR and radio sources (Mrk 180, 231, 421, 501, etc.), BCDGs (Mrk 116) and interacting/merging systems (Mrk 266, 273, etc.). They led to the classification of Seyfert galaxies into Sy1 and Sy2 and the definition of Starbursts (SB). Several catalogs of Markarian galaxies have been published (Mazzarella & Balzano 1986; Markarian et al. 1989; Bica et al. 1995; Petrosian et al. 2007) and they are accessible in all corresponding databases. Markarian survey also served as a basis for search for UVX stellar objects (including QSOs and Seyferts), late-type stars and optical identification of IR sources. At present the survey is digitized and DFBS database is available. I will review the main characteristics of the Markarian survey, its comparison with other similar surveys and the importance of Markarian galaxies in modern astrophysics.

### ***Revised activity types for Markarian galaxies***

**Mickaelian, A. M.; Abrahamyan, H. V.;** Harutyunyan, G. S.; **Paronyan, G. M.** (Proc. IAU S304, 41, 2014)

The sample of Markarian galaxies consists of 1515 UV-excess galaxies containing many active galaxies, both AGN and Starburst (SB). Several catalogs of Markarian galaxies have been published; however activity types are based on old spectroscopic data. The SDSS spectroscopy and some other recent spectral observations allow classify or re-classify many of Markarian galaxies, altogether we have retrieved and studied 779 SDSS and 300 other spectra. Out of 779 SDSS spectra, we have classified 533 HII, 31 Composites, 12 LINERs, 4 S2.0, 5 S1.9, 8 S1.8, 5 NLS1.5, 11 S1.5, 8 NLS1.2, 21 S1.2, 4 NLS1, 4 S1.0, 2 QSO, 11 AGN (without an exact class), 52 Em (HII or AGN), 65 Abs, and 3 Stars. On the other hand, the galaxies are being classified depending on the fact in which wavelength range they have been observed and studied. E.g. some Sy2 type galaxies turn to be Sy1 when classified in IR. Many hidden AGN (in X-ray and IR) appear to be normal galaxies in optical range. So for better understanding, IR spectra are necessary as well.

### ***Analysis and Statistics of the Spectroscopic Sample of Byurakan-IRAS Galaxies***

**Harutyunyan, G. S.; Mickaelian, A. M.** (Proc. IAU S304, 68, 2014)

A summary and general analysis of optical spectroscopic data for 255 Byurakan-IRAS Galaxies (BIG) obtained with BAO 2.6m, SAO 6m, OHP 1.93m telescopes, as well as SDSS DR7, DR8, and DR9 is given. The 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 spiral galaxies and there is a number of ULIRGs. All but one have emission lines; we have discovered 68 AGN and composite spectrum objects among them and the others are mostly Starburst Galaxies (SB). All possible physical characteristics have been measured and/or calculated, including physical

sizes and optical and IR/FIR luminosities. The masses have been estimated based on mass-luminosity relations for spiral galaxies. As it appears, most of these objects are giant massive galaxies. Various multiwavelength (MW) data have been retrieved from recent catalogues from X-ray to radio and MW SEDs have been built, which have been matched to their optical classifications. Luminosity evolution of these objects has been studied.

### ***Study of Starburst/Activity/Interaction Phenomena based on the Multiple Byurakan-IRAS Galaxies***

**Harutyunyan, G. S.; Mickaelian, A. M.** (Proc. IAU S304, 383, 2014)

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 spiral galaxies and many have been proved to be AGN and starburst by spectroscopic observations, as well as there is a number of ULIRGs among these objects. BIG objects contain galaxy pairs, multiples, and small groups that are subject for study on the matter of the real IR-emitter in these systems. Given that these objects are powerful IR sources, they are considered as young systems indicating high rate of evolution and starburst activity exceeding 100  $M_{\odot}/\text{yr}$ . Spectroscopic observations show that all these systems are physical ones and we were able to measure the mutual distances and sizes for all components. Cross-correlations with the recent more accurate IR catalogues, such as 2MASS and WISE, as well as radio ones (NVSS, FIRST), provided accurate coordinates of the IR source and possibility to find the individual galaxy responsible for the IR. However, in almost half of the cases, IR position indicates the intermediate region between the components, which means that it comes from the system as a whole. Some more MW data have been matched to IR and radio to have an overall understanding on these systems. Given that these systems are mostly interacting/merging ones often containing AGN and most of them may be considered as powerful starbursts, it is possible to study starburst/activity/interaction phenomena and their interrelationship.

### ***Study of a homogeneous X-ray selected AGN sample***

**Paronyan, G. M.; Mickaelian, A. M.; Abrahamyan, H. V.** (Proc. IAU S304, 161, 2014)

Based on optical identifications of ROSAT sources, we have created a large homogeneous catalog of X-ray selected AGN. The Hamburg-RASS Catalog (HRC) and Byurakan-Hamburg-RASS Catalog (BHRC) made up on the basis of optical identification of X-ray sources from ROSAT Bright Source (BSC) and Faint Source (FSC) catalogues, respectively, have been used. These identifications were based on low-dispersion spectra of Hamburg Quasar Survey (HQS). As a result, a new large sample of X-ray selected AGN has been compiled containing 4253 sources with photon count rate  $CR > 0.04$  ct/s in the area with galactic latitudes  $|b| > 20$  and declinations  $\delta > 0$ . All these sources are classified as AGN or candidate AGN. We have carried out multiwavelength studies in several wavelength ranges (X-ray, optical, radio). Catalogues that more or less guarantee the completeness condition (all-sky or large area surveys) were used. A number of erroneous classifications were found (some AGN had been classified as stars or galaxies); 1024 and 59 from HRC and BHRC, respectively. Out of 4253 sources, 3352 are spectroscopically confirmed AGN (given in Veron-Cetty & Veron and Roma Blazar catalogs), and the rest 901 are candidate AGN. For 210 of them spectra are available in SDSS DR9, and the results of their classification are given in another paper. We calculated absolute magnitudes, fluxes, improved coordinates and redshifts. An attempt is made to find a connection between the radiation fluxes in different bands for different types of sources, and identify their typical characteristics, thus confirming candidate AGN and in some cases finding new ones.

### ***Activity types for X-ray candidate AGN from SDSS***

**Paronyan, G. M.; Harutyunyan, G. S.; Mickaelian, A. M.** (Proc. IAU S304, 166, 2014)

The Joint Catalogue of Hamburg ROSAT Sources (HRC/BHRC) is the result of merging of HRC and BHRC catalogs built on the basis of optical identifications of ROSAT BSC and ROSAT FSC. Altogether, 8132 sources are present. Based on this catalogue, we have compiled a sample of ROSAT AGN, including candidate ones. In this paper we classify candidate AGN (those that previously had not been spectroscopically classified) by their activity type. The sample contains 955 objects with count rate of photons  $CR > 0.04$  ct/s in the area with galactic latitudes  $|b| > 30$  and declinations  $\delta > 0$ , however only 217 objects have SDSS DR10 spectra. The classification led to the following results: 95 AGN, 71 absorption-line galaxies, 42 stars, and 9 unclassified objects.

### ***The ROSAT/NVSS AGN sample***

**Paronyan, G. M.; Abrahamyan, H. V.; Harutyunyan, G. S.; Mickaelian, A. M.** (Proc. IAU S304, 164, 2014)

We attempt to create an X-ray/radio AGN catalog and make its multiwavelength studies. ROSAT Bright Source Catalogue (BSC) contains 18,806 and ROSAT Faint Source Catalogue (FSC), 105,922 X-ray sources giving the total number of ROSAT X-ray sources 124,727 (one source is listed twice). On the other hand, NVSS radio catalogue contains 1,773,484 sources. Taking into account that X-ray sources contain AGN, bright stars and galaxies, clusters, white dwarfs (WD), cataclysmic variables (CV), etc., the cross-identification with radio catalogue may distinguish the extragalactic sources. We have cross-correlated ROSAT catalogs with NVSS one with a search radius 30 arcsec. 9,193 associations have been found. To distinguish AGN from the normal bright galaxies and clusters, Veron-Cetty & Veron AGN catalog (v.13, 2010; VCV-13) containing 168,940 objects have been used. A cross-correlation of the 9,193 ROSAT/NVSS sources with the VCV-13 with a search radius 30 arcsec resulted in 3,094 associations. Thus we are left with more 6,099 X-ray/radio sources without an optical identification. Brighter objects are normal bright galaxies, while we believe that all faint ones are candidate AGN with some contamination of distant clusters. SDSS spectroscopic survey allows us classify objects by activity types, and a number of our candidate AGN is found to be present in SDSS. We attempt to find connections between the fluxes in different wavelength ranges, which will allow us to confirm AGN and blazars candidates and in some cases find new ones.

### ***Investigation of Extragalactic Radio Sources by Cross-Matching of Radio Catalogs***

**Abrahamyan, H. V.; Mickaelian, A. M.** (Proc. IAU S304, 100, 2014)

To search for variable radio sources, we used two well-known radio catalogs NVSS and FIRST, both providing fluxes at 1400 MHz. Cross-correlation enabled us to find 556,282 radio sources present in both catalogs. Using the  $3\sigma$  criteria we distinguished 6,301 variable radio sources, and with certain limitations specified the 260 strongest radio variables. We cross-correlated these 260 sources with other catalogs at different wavelengths (APM, SDSS DR10, VCV-13, BZCAT, 2MASS, and WISE). As a result we obtained photometric data for optical, NIR, MIR and radio ranges for these 260 variable radio sources to study them in details.

### ***Radio Properties of AGN***

**Abrahamyan, H. V.; Mickaelian, A. M.** (Proc. IAU S304, 102, 2014)

To study the radio properties of AGN, we cross-correlate and investigate Veron-Cetty & Veron catalog of QSOs and Active Galaxies (v.13, 2010) with a number of radio catalogs: NVSS, FIRST, GB6, 87GB, SUMSS, WISH, WENSS, and 7C. This catalog contains 168,940 objects with positional accuracy of mostly 1 arcsec, though many positions have larger errors. We use new cross-correlation software based on accuracy of each object independently. In this software we take into account errors for each source and take identifications with errors within 3 sigma. Altogether, we find ~16,000 AGN having radio detection in any of the listed catalogs. Using all data from radio catalogs, we derive a homogeneous sample of radio AGN. The sample allows accomplish several tasks, including study of the distribution of radio sources by activity types, differences in physical properties of radio-loud and radio-quiet AGN, luminosity functions for various types of radio AGN, study of the  $q$  parameter by AGN types and its evolution, etc.

### ***Star Formation Rates from [C II] 158 $\mu$ m and Mid-infrared Emission Lines for Starbursts and Active Galactic Nuclei***

**Sargsyan, L.; Samsonyan, A.; et al.** (ApJ 790, article id. 15, 2014)

A summary is presented for 130 galaxies observed with the Herschel Photodetector Array Camera and Spectrometer instrument to measure fluxes for the [C II] 158  $\mu$ m emission line. Sources cover a wide range of active galactic nucleus to starburst classifications, as derived from polycyclic aromatic hydrocarbon strength measured with the Spitzer Infrared Spectrograph. Redshifts from [C II] and line to continuum strengths (equivalent width (EW) of [C II]) are given for the full sample, which includes 18 new [C II] flux measures. Calibration of  $L([C II])$  as a star formation rate (SFR) indicator is determined by comparing [C II] luminosities with mid-infrared [Ne II] and [Ne III] emission line luminosities; this gives the same result as determining SFR using bolometric luminosities of reradiating dust from starbursts:  $\log SFR = \log L([C II]) - 7.0$ , for SFR in  $M_{\odot} \text{ yr}^{-1}$  and  $L([C II])$  in  $L_{\odot}$ . We conclude that  $L([C II])$  can be used to measure SFR in any source to a precision of ~50%, even if total source luminosities are dominated by an active galactic nucleus (AGN) component. The line to continuum ratio at 158  $\mu$ m,  $EW([C II])$ , is not significantly greater for starbursts (median  $EW([C II]) = 1.0 \mu\text{m}$ ) compared to composites and AGNs (median  $EW([C II]) = 0.7 \mu\text{m}$ ), showing that the far-infrared continuum at 158  $\mu$ m scales with [C II] regardless of classification. This indicates that the continuum at 158  $\mu$ m also arises primarily

from the starburst component within any source, giving  $\log \text{SFR} = \log \nu L_\nu(158 \mu\text{m}) - 42.8$  for SFR in  $M_\odot \text{ yr}^{-1}$  and  $\nu L_\nu(158 \mu\text{m})$  in  $\text{erg s}^{-1}$ . Based on observations with the Herschel Space Observatory, which is an ESA space observatory with science instruments provided by European-led Principal Investigator consortia and with important participation from NASA.

### ***Seeking the Epoch of Maximum Luminosity for Dusty Quasars***

Vardanyan, V.; Weedman, D.; **Sargsyan, L.** (ApJ 790, article id. 88, 2014)

Infrared luminosities  $\nu L_\nu(7.8 \mu\text{m})$  arising from dust reradiation are determined for Sloan Digital Sky Survey (SDSS) quasars with  $1.4 < z < 5$  using detections at  $22 \mu\text{m}$  by the Wide-Field Infrared Survey Explorer. Infrared luminosity does not show a maximum at any redshift  $z < 5$ , reaching a plateau for  $z > 3$  with maximum luminosity  $\nu L_\nu(7.8 \mu\text{m}) > \sim 10^{47} \text{ erg s}^{-1}$  luminosity functions show one quasar  $\text{Gpc}^{-3}$  having  $\nu L_\nu(7.8 \mu\text{m}) > 10^{46.6} \text{ erg s}^{-1}$  for all  $2 < z < 5$ . We conclude that the epoch when quasars first reached their maximum luminosity has not yet been identified at any redshift below 5. The most ultraviolet luminous quasars, defined by rest frame  $\nu L_\nu(0.25 \mu\text{m})$ , have the largest values of the ratio  $\nu L_\nu(0.25 \mu\text{m})/\nu L_\nu(7.8 \mu\text{m})$  with a maximum ratio at  $z = 2.9$ . From these results, we conclude that the quasars most luminous in the ultraviolet have the smallest dust content and appear luminous primarily because of lessened extinction. Observed ultraviolet/infrared luminosity ratios are used to define "obscured" quasars as those having  $>5$  mag of ultraviolet extinction. We present a new summary of obscured quasars discovered with the Spitzer Infrared Spectrograph and determine the infrared luminosity function of these obscured quasars at  $z \sim 2.1$ . This is compared with infrared luminosity functions of optically discovered, unobscured quasars in the SDSS and in the AGN and Galaxy Evolution Survey. The comparison indicates comparable numbers of obscured and unobscured quasars at  $z \sim 2.1$  with a possible excess of obscured quasars at fainter luminosities.

### ***Galaxies with Binary Nuclei***

Terzian, Y.; **Khachikian, E.** (Proc. IAU S304, 363, 2014)

It is known that among active galaxies (AG) with strong emission lines (UV-galaxies, Sy1 and Sy2, Markarian and Kazarian galaxies, radio-galaxies, QSOs host galaxies and so on) there is a large percentage of objects with double and multiple (or complex) nuclei. The common sizes of these nuclei are of the order of a few hundred parsecs or kiloparsecs. We shall discuss the results of morphological and spectroscopic observations of a number of "active galaxies" carried out with the 5m Palomar telescope, 2.6m telescope of Ambartsumian Byurakan Astrophysical Observatory, 6m telescope of Special Astrophysical Observatory in Russia, and newer Hubble Space Telescope data.

### ***Ultra-high energy neutrino fluxes from supermassive AGN black holes***

**Ter-Kazarian, G.** (ApSS 349, 919, 2014)

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)— to  $3.18 \times 10^{-4}$ , with the average, where  $\epsilon_d \sim 10^{-12}$  is the opening parameter; (2) (pionic reactions)—, with the average ; and (3) (modified URCA processes)—, with the average. 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  $\theta \sim \epsilon_d$ .

### ***Study of SBS 1202+583. Features of the Radial Velocity Distribution over the Field***

**Hakopian, S. A.** (Ap 57, 352, 2014)

This article is a continuation of our study of the galaxy SBS 1202+583 (VV270ab) by using panoramic spectroscopy data obtained in our observations with multipupil spectrographs - the MPFS at the 6-m telescope of the SAO of the Russian Academy of Sciences and the "VAGR" at the 2.6-m telescope of the BAO in Armenia. An analysis of the radial velocity field in the H $\alpha$  emission line of this object, previously characterized as a complex consisting of more than nine HII regions [1], indicates the two main substructures of them. The closest substructure associated with the HII region SBS1202+583C1 (from the component VV270b) is disintegrating under the influence of a distant substructure associated with SBS1202+583NE4 (from the component VV270a) which is the most massive and most powerful H $\alpha$  emission source. The perturbation field, owing to its gravitational effect, stimulates a directed motion of most of the HII regions as they rotate simultaneously.

### ***Complex Investigation of SBS Galaxies in Seven Selected Fields***

**Hakopian, S.** (Proc. IAU S304, 36, 2014)

It is known that the main criterion for the selection of active objects in the First Byurakan, otherwise Markarian survey was the presence of signs of UV-excess in their low-dispersion spectra. Using the presence of emission lines as the second criteria became real during the Second Byurakan survey because of its improved technique. Extended (not stellated) objects, selected with the use of this criterion, made the main part of the separate sample of SBS galaxies. Originally, this sample included 1286 objects, selected in 65 fields of the survey (16 square degree each), to which, with the help of other sources than the survey, there were later added some objects. We studied a subsample of SBS galaxies in seven selected fields (the deepest according to the  $V/V_{\max}$  criterion), including about the third of the whole sample. The first, already completed phase of this program was started with carrying out a follow-up slit spectroscopy of all, about 500 objects, based on observations with long-slit spectrographs with 6m telescope of SAO Russia and 2.6m telescope of Byurakan. As a result redshifts were determined, as well as spectral classification was made for all of objects, using the scheme adapted to the spectral material. Besides other, obtained data allowed us to estimate the efficiency of used criteria for the selection of galaxies of different classes of starformation and nuclear activity along the full scale of the apparent magnitudes, including close to the limit values ( $18.5 < m_{pg} < 19.5$ ), etc. The fact that the total area of seven fields as the total number of objects in them comparable with these values for the survey as a whole, allows us to extrapolate the results to the whole sample of galaxies as an upper estimate. The second stage is to conduct detailed studies of individual galaxies in the first place, the most interesting in terms of morphology. They are based on panoramic spectroscopy obtained from observations at 6 m telescope of Russia and 2.6m telescope of Byurakan carried out with multipupil spectrographs MPFS and VAGR, correspondently. Processing of the data obtained for more than twenty objects are at different stages (see arXiv:1403.0127 for extended version).

### ***Results on Panoramic Spectroscopy of Mrk 171***

**Hakopian, S. A.; Balayan, S. K.; Movsessian, T. A.** (Proc. IAU S304, 411, 2014)

Observations of Mrk 171, aimed at conduction of panoramic spectroscopy, were undertaken with the Byurakan 2.6-m telescope using spectrograph "VAGR". Within the two components of the galaxy, Mrk171W and Mrk171E, there were differentiated eight condensations of starforming activity, i.e. HII-regions, and no sign of AGN activity was revealed in spite of existing suggestions.

### ***The physical conditions and oxygen and nitrogen abundance of 36 SBS galaxies from the SDSS DR7***

**Gyulzadyan, M. V.; Adibekyan, V. Z.** (Proc. IAU S304, 34, 2014)

Physical conditions and oxygen and nitrogen abundances in 36 SBS UV-excess and/or emission-line galaxies from the SDSS DR7 were determined. We have found that SBS 0808+578 is AGN. The others are HII galaxies or HII regions in galaxies. For all objects the oxygen abundance  $12+\log(O/H)$  lies in the range of  $7.85 \div 8.61$  and  $\log(N/O)$  ratio in the range of  $-1.45 \div -0.4$ . They occupy the same area in the diagram  $N/O$   $O/H$  as the high-excitation HII regions. We found no extremely metal-deficient galaxy. Using H-alpha fluxes star formation rates (SFR) for our samples galaxies were determined. Determined SFRs, being in the range of  $0.001 \div 6 \text{ } \text{o year}^{-1}$ , are similar of that observed in typical star forming regions in spiral and irregular galaxies.

### ***Study of Compact Radio Galaxies in the 7C II Field***

**Abrahamyan, H. V.; Andreasyan, R. R.; Hovhannisyan, M. A.; Paronyan, G. M.** (Ap 57, 359, 2014)

26 radio galaxies in field II of the Cambridge 7C list which scintillate at 102 MHz are studied in detail to clarify the major physical and structural features of these extragalactic radio sources. The results are compared with data for scintillating quasars in the same field.

### ***Study of some morphological features of extragalactic radio sources of FRI and FRII types***

**Andreasyan, R.; Hovhannisyan, M.; Paronyan, G.; Abrahamyan, H.** (Proc. IAU S304, 104, 2014)

It was used the data of more than 650 extragalactic radio sources for the study of distribution of spectral indexes and elongation for the radio sources of different Fanaroff-Riley (FR) classes. It was shown, that no large differences are observed in the distribution of spectral indexes in radio sources FRI and FRII classes. From the study of distribution of the elongation of extragalactic radio sources it was found the following basic morphological differences for the objects of different FR classes: a) the radio images of extragalactic radio sources FRII type in the average are more elongated than the radio images of extragalactic radio sources FRI type: b) the extragalactic radio sources FRI type can be divided on two subtypes with two function of distribution of the elongation parameter K having different maximums. These two

subtypes of radio sources of FRI class, in besides of different average elongation of radio images, probably must have also differences in the orientations of these elongation directions relative to the direction of rotation axes of parent optical galaxies that in most cases are coincide with the minor optical axes of galaxies.

### ***Investigation of Distant Quasars***

Hovhannisyan, M.; Andreasyan, R.; Paronyan, G.; Abrahamyan, H. (Proc. IAU S304, 236, 2014)

To study physical and morphological characteristics of distant quasars we carry out radio-optical investigation of 30 quasars from the Cambridge 7C catalogue second area (0.097 square radians). All these objects have angular sizes less than 1 arcsec on 102 MHz images. Average values of absolute magnitudes and spectral indices have been calculated for them ( $M = -26.51 \pm 0.25$ ,  $a = 0.66 \pm 0.25$ ). It was shown that 60% of compact radio sources from the FIRST catalogue (1400 MHz) are candidates of distant quasars.

### ***AGN populations in compact groups of galaxies***

Amirkhanian, A. S.; del Olmo, A.; Egikian, A. G.; et al. (Proc. IAU S304, 337, 2014)

Compact groups of galaxies (CGG) have revealed some interesting problems from their origin and lifetime to the evolution of their members in such dense configurations. Some authors suppose that CGG probably are the best location for AGNs in the local Universe. According to our preliminary data about 7-10% of member galaxies in Shahbazian compact groups (SHCGs) are emission-line galaxies including the broad-line AGN and the narrow emission-line galaxies. Shahbazian 355/4 is a classical Seyfert 1 galaxy at the same redshift as host group. Moreover Shahbazian 278/4 is also a broad-line AGN in an early-type galaxy. This is the first emission-line object in SHCGs. Meanwhile there is no Seyfert 1 galaxy among the spectroscopically investigated galaxies in the South compact groups, although more than 70% of the member galaxies in these groups probably have an active nucleus. The UZC- compact groups have an excess of Seyfert 2s (but not Seyfert 1s!). Further observational studies are necessary to understand such and many other questions related to the puzzle of CGG.

### ***The Role of Radio Loud Phase of Nuclear Activity in Galaxy Formation and Evolution***

Ohanian, G. A. (Proc. IAU S304, 419, 2014)

Key questions, which arise when one tries to clear up a problem of formation and evolution of galaxies, is the question of energy: what is the energetic budget of AGN owing to form galaxies and provide its subsequent development? Hence, for understanding the formation and evolution of galaxies, it is important to estimate the energetic budget of AGN which we try to do involving radio loud phase of nuclear activity.

### ***Is it Possible to Find Signs of the Evolution of Anomalous Redshift by Studying Galaxies in a Single Cluster?***

Harutyunian, H. A.; Harutyunyan, V. S. (Ap 57, 484, 2014)

We have compiled a list of dwarf galaxies that are possible members of the Virgo cluster. The dependence of the radial velocities on stellar magnitude is studied. Average values of the radial velocities for the galaxies are calculated with a step size of one stellar magnitude for partial compensation of the local velocities. Despite a large spread in velocities, there is a clear tendency for the average radial velocity to decrease as the galaxies become fainter. This tendency can be interpreted as a more rapid evolution of the dwarf galaxies in the sense of an adjustment to a change in spatial scale owing to accelerated expansion of space.

### ***Are the "Physically Bound Systems" beyond the Cosmological Expansion Effect? (A provocative musing on the given theme)***

Harutyunian, H. A. (Proc. IAU S304, 391, 2014)

Influence of the dark energy at small scales is considered. Interaction and energy exchange between ordinary matter and dark energy is proposed as a working hypothesis. Some observational facts are put into the base of this consideration: the large rate of lunar retreat and the acceleration of cosmic expansion which proves the energy exchange between ordinary matter and dark energy. If the possibility of the space and matter expansion at the scales under consideration is accepted one can show that the dark energy transformed into the object's potential energy is enough to generate cluster of galaxies over the Hubble time due to matter ejection mechanism.

### ***Distribution of Spiral Galaxies in the Virgo and Fornax Clusters and Their Dynamic Features***

Kogoshvili, N. G.; Borchkhadze, T. M.; **Kalloghlian, A. T.** (Ap 57, 473, 2014)

The dynamic characteristics of spiral galaxies with absolute magnitudes  $M \geq -20^m.6$  in the Virgo and Fornax clusters are studied using data from the Merged Catalog of Galaxies MERCG. The galactic diameters from MERCG are used to determine the radius  $R_D$  that defines the region of possible concentration of dark matter, and the dynamic parameters  $M_{\text{dyn}}$  and  $M_{\text{dyn}}/L_B$  of the spiral galaxies are calculated based on the centrifugal equilibrium condition. Results from the theory of angular momentum transfer are used to estimate the central surface density  $m_0$  and angular momentum  $K$  of stars in these galaxies. A comparison of the dynamic parameters of the spiral galaxies with  $M \geq -20.6$  and  $M \leq -20.6$  reveals a statistically significant higher fraction of dark matter in the spiral galaxies with  $M \leq -20.6$ , at 26.3% in Virgo and 27% in Fornax.

### ***Studies of the Jet in BL Lacertae. I. Recollimation Shock and Moving Emission Features***

Cohen, M. H.; Meier, D. L.; **Arshakian, T. G.**; et al. (ApJ 787, article id. 151, 2014)

Parsec-scale VLBA images of BL Lac at 15 GHz show that the jet contains a permanent quasi-stationary emission feature 0.26 mas (0.34 pc projected) from the core, along with numerous moving features. In projection, the tracks of the moving features cluster around an axis at a position angle of  $-166.^{\circ}6$  that connects the core with the standing feature. The moving features appear to emanate from the standing feature in a manner strikingly similar to the results of numerical two-dimensional relativistic magneto-hydrodynamic (RMHD) simulations in which moving shocks are generated at a recollimation shock (RCS). Because of this, and the close analogy to the jet feature HST-1 in M87, we identify the standing feature in BL Lac as an RCS. We assume that the magnetic field dominates the dynamics in the jet, and that the field is predominantly toroidal. From this we suggest that the moving features are compressions established by slow and fast mode magneto-acoustic MHD waves. We illustrate the situation with a simple model in which the slowest moving feature is a slow-mode wave, and the fastest feature is a fast-mode wave. In the model, the beam has Lorentz factor  $\Gamma_{\text{beam}}^{\text{gal}} \approx 3.5$  in the frame of the host galaxy and the fast mode wave has Lorentz factor  $\Gamma_{\text{Fwave}}^{\text{beam}} \approx 1.6$  in the frame of the beam. This gives a maximum apparent speed for the moving features,  $\beta_{\text{app}} = v_{\text{app}}/c = 10$ . In this model the Lorentz factor of the pattern in the galaxy frame is approximately three times larger than that of the beam itself.

### ***Studies of the Jet in BL Lacertae. II. Superluminal Alfvén Waves***

Cohen, M. H.; Meier, D. L.; **Arshakian, T. G.**; et al. (eprint arXiv:1409.3599, 2014)

We study the kinematics of ridge lines on the pc-scale jet of the active galactic nucleus BL Lac. We show that the ridge lines display transverse patterns that move superluminally downstream, and that the moving patterns are analogous to waves on a whip. Their apparent speeds  $\beta_{\text{app}}$  (units of  $c$ ) range from 3.9 to 13.5, corresponding to  $\beta_{\text{wave}}^{\text{gal}} = 0.981 - 0.998$  in the galaxy frame. We show that the magnetic field in the jet is well-ordered with a strong transverse component, and assume that it is helical and that the transverse patterns are Alfvén waves propagating downstream on the longitudinal component of the magnetic field. The wave-induced transverse speed of the jet is non-relativistic ( $\beta_{\text{tr}}^{\text{gal}} \leq 0.09$ ). In 2010 the wave activity subsided and the jet then displayed a mild wiggle that had a complex oscillatory behaviour. The Alfvén waves appear to be excited by changes in the position angle of the recollimation shock, in analogy to exciting a wave on a whip by shaking the handle. A simple model of the system with plasma sound speed  $\beta_s = 0.3$  and apparent speed of a slow MHD wave  $\beta_{\text{app,S}} = 4$  yields Lorentz factor of the beam  $\Gamma_{\text{beam}} \sim 4.5$ , pitch angle of the helix (in the beam frame)  $\alpha \sim 67^{\circ}$ , Alfvén speed  $\beta_A \sim 0.64$ , and magnetosonic Mach number  $M_{\text{ms}} \sim 4.7$ . This describes a plasma in which the magnetic field is dominant and in a rather tight helix, and Alfvén waves are responsible for the moving transverse patterns.

### ***MOJAVE/2cm AGN sample opt. spectros. Atlas***

Torrealba, J.; Chavushyan, V.; Cruz-Gonzalez, I.; **Arshakian, T. G.**; et al. (VizieR On-line Data Catalog: J/other/RMxAA/48.9. Originally published in: 2012RMxAA..48....9T, 2014)

The atlas includes spectral parameters for the emission lines  $H\beta$ , [OIII] 5007, MgII 2798 and/or CIV 1549 and corresponding data for the continuum, as well as the luminosities and equivalent widths of the FeII UV/optical. It also contains homogeneous photometric information in the B-band for 242 sources of the MOJAVE/2cm sample. These data were acquired at 2.1m Mexican telescopes: Observatorio Astronomico Nacional in San Pedro Martir (OAN-SPM), B. C., Mexico and at Observatorio Astronomico Guillermo Haro, in Cananea, Sonora (OAGH), Mexico. It is supplemented with spectroscopic data found in the archives of the Sloan Digital Sky Survey (SDSS), the Hubble Space Telescope (HST), in the AGN sample of Marziani et al. (2003ApJS..145..199M, Cat. J/ApJS/145/199), and in Lawrence et al. 1996ApJS..107..541L. We present the continuum emission and/or line parameters for 41 sources in the  $H\beta$  region, 78 in the MgII region, and 35 in the CIV region. Also, there are 14 sources with information available for both  $H\beta$  and MgII



regions, 12 with MgII and CIV, and 5 with H $\beta$ , MgII and CIV. The spectroscopic information for the statistically complete sample MOJAVE-1 (Lister & Homan, 2005AJ....130.1389L, Cat. J/AJ/130/1389) included in the Atlas is as follows: 28 sources in the H $\beta$  region, 46 in the MgII region, and 23 in the CIV region. All the emission lines parameters are for the broad component of the line, except for [OIII] 5007.

### ***The central pc-scale region in blazars: insights from multi-band observations***

**Arshakian, T. G.;** Chavushyan, V. (Proc. IAU S304, 257, 2014)

The empirical relations in the black hole-accretion disk-relativistic jet system and physical processes behind these relations are still poorly understood, partly because they operate close to the black hole within the central light year. Very long baseline array (VLBA) provides unparalleled resolution at 15 GHz with which to observe the jet components at sub-milliarcsecond scales, corresponding to sub-pc-scales for local blazars. We discuss the jet inner structure of blazars, location and radiation mechanisms operating in the innermost parsec-scale region of blazars, and evidence for jet-excited broad-line region (BLR) outflowing downstream the jet. Outflowing BLR can provide necessary conditions for production of high energy emission along the jet between the base of the jet and the BLR and far beyond the BLR as evidenced by recent observations. Flat spectrum quasars and low synchrotron peaked sources are the most likely objects to host the outflowing BLR. From the  $\gamma$ -ray absorption arguments, we propose that the jet-excited region of the outflowing BLR in quasars is small and/or gas filling factor is low, and that the orientation and opening angle of the outflowing BLR can lead to relevant  $\gamma$ -ray absorption features observed in quasars.

### ***The Parsec-scale Structure, Kinematics, and Polarization of Radio-Loud Narrow-Line Seyfert 1 Galaxies***

Richards, J. L.; ...; **Arshakian, T. G.;** Chavushyan, V. (eprint arXiv:1411.1058, 2014)

Several narrow-line Seyfert 1 galaxies (NLS1s) have now been detected in gamma rays, providing firm evidence that at least some of this class of active galactic nuclei (AGN) produce relativistic jets. The presence of jets in NLS1s is surprising, as these sources are typified by comparatively small black hole masses and near- or super-Eddington accretion rates. This challenges the current understanding of the conditions necessary for jet production. Comparing the properties of the jets in NLS1s with those in more familiar jetted systems is thus essential to improve jet production models. We present early results from our campaign to monitor the kinematics and polarization of the parsec-scale jets in a sample of 15 NLS1s through multifrequency observations with the Very Long Baseline Array. These observations are complemented by fast-cadence 15 GHz monitoring with the Owens Valley Radio Observatory 40m telescope and optical spectroscopic monitoring with the 2m class telescope at the Guillermo Haro Astrophysics Observatory in Cananea, Mexico.

## ***Theoretical Astrophysics (4)***

### ***Groups and their Representations in the Theory of Radiative Transfer. I***

**Nikoghossian, A. G.** (Ap 57, 272, 2014)

This is a study of the group-theoretical description of radiative transfer in inhomogeneous, multicomponent atmospheres with the plane-parallel geometry. It consists of two parts and generalizes results recently obtained by the author for the simplest scalar problems of transfer in a 1D medium to the matrix case where the spatial and frequency distributions of the radiation field are taken into account. The group of compositions of media with different optical and physical properties is defined. Group representations are found for two possible cases of illumination of a composite atmosphere of finite optical thickness. An algorithm for determining the global optical characteristics of inhomogeneous and composite atmospheres is described. The theory developed here is illustrated for the example of radiative diffusion with partial redistribution over frequency in an atmosphere whose inhomogeneity is due to by changes in the scattering coefficient with depth.

### ***Groups and Their Representations in the Theory of Radiative Transfer. II***

**Nikoghossian, A. G.** (Ap 57, 375, 2014)

The operator-matrix description of radiative transfer developed in the first part of this paper is used to find the radiation field inside an inhomogeneous atmosphere. An important result along the way is separation of the variables of optical thickness and depth. The concept of a group of optical depth translation is introduced. It is shown that the latter is equivalent to the group of compositions of media with different optical and physical properties introduced in the first part of this paper. Representations are found for the group of translations. Radiative transfer problems in inhomogeneous atmospheres with internal energy sources and in an atmosphere with an infinite optical thickness are discussed.

### ***Growth of Accreting Supermassive Black Hole Seeds and Neutrino Radiation***

**Ter-Kazarian, G. T.** (Journal of Astrophysics, Article ID 205367, 2014)

### ***Modified Theories of Gravitation behind the Spacetime Deformation***

**Ter-Kazarian, G. T.** (Physics Research International, Article ID 152846, 2014)

## ***Surveys, Databases (2)***

### ***The IRAS PSC/FSC Combined Catalogue***

**Abrahamyan, H. V.; Mickaelian, A. M.; Knyazyan, A. V.** (Astronomy & Computing, Online publication, 2014)

Optical identifications of a few thousands of IRAS sources showed that IRAS Point Source and IRAS Faint Source catalogues (PSC and FSC, respectively) contain many quasars and active galactic nuclei, late-type stars, planetary nebulae, variables etc. To increase the efficiency of using IRAS PSC and FSC, which contain a lot of common sources, one needs a joint catalogue of all IRAS point sources with improved data based on both catalogues. However, cross-correlation of the catalogues is not so easy, as the association of many sources is relative, and not always it is obvious, which source from one catalogue corresponds to the other one in the second catalogue. This problem exists in case of using standard cross-correlation tools like Vizier. Therefore, we have created a tool for cross-matching astronomical catalogues and we have applied it to IRAS PSC and FSC. Using this tool we have carried out identifications with a search radius corresponding to  $3\sigma$  of errors for each source individually rather than a standard radius for all sources. As a result, we obtained 73,770 associations. We showed that in case of cross-correlation of these catalogues by Vizier, we had to take 161.95 arcseconds radius not to lose any association; however, in this case a lot of false associations appear for many sources. In addition, we have made cross-correlations with AKARI-IRC, AKARI-FIS and WISE catalogues. As a result we created a catalogue with high positional accuracy and with 17 photometric measurements from 1.25 to 160  $\mu\text{m}$  range, providing a detailed catalogue for IRAS point sources.

### ***Byurakan Astrophysical Observatory plate archive and its scientific usage***

**Mickaelian, A. M.** (Proc. Astroplate2014, p. 109, 2014)

The Byurakan Astrophysical Observatory (BAO) has one of the richest collections of observational data. Several telescopes have worked in photographic mode for dozens of years during 1947-1991 and left dozens of thousands direct images, thousands of objective prism plates and thousands of spectra on films. BAO is especially known for its famous surveys; the First Byurakan Survey (FBS, Markarian survey) is a unique material, some 2000 objective prism plates, each containing some 15,000-20,000 low-dispersion spectra, as well as Second Byurakan Survey (SBS) and some other surveys are available. BAO Plate Archive was organized in 1986 and since then most of the plates have been collected, altogether 37,500 plates. The FBS was digitized and the DFBS spectroscopic database was created, as well as several other sets of plates and films were scanned. A number of science projects have been and are being accomplished using the archival data, such as optical identifications of IR sources, study of Solar System objects (comets, asteroids), spectral classification of objects using film spectra, search and study of variable objects (stars, blazars), high proper motion stars, etc.

## ***Books, Theses (4)***

### ***Multiwavelength AGN Surveys and Studies***

**Mickaelian, A. M.; Sanders, D. B. (Eds.)** (Proc. IAU Symp. #304, Cambridge University Press, 437 p., 2014)

IAU Symposium #304 “Multiwavelength AGN Surveys and Studies” took place in Yerevan, Armenia on 7-11 October 2013. It was the largest symposium ever held in Armenia both by the number of its participants and represented countries and its international significance. The Symposium was dedicated to B. E. Markarian’s 100<sup>th</sup> anniversary. The subject “Multiwavelength AGN surveys and studies” included all surveys from historical to recent ground-based and space ones, future projects, the unification and other models of AGN, accretion modes, the structure of nearby AGN, AGN feedback in galaxies and clusters, host galaxies and the AGN environments, binary AGN and merging Super-Massive Black Holes (SMBH), unique AGN, variability and the phenomena of activity. A combined study of all multiwavelength data gives the overall picture of the AGN and answers some of the most important questions: - understanding the possible evolutionary and/or physical connection between the different classes of AGN, i.e. their consistency with the unification

model; - the relation of AGN to their host galaxies; - understanding the true fraction of heavily obscured AGN in order to determine the true AGN luminosity function and its variation with redshift. The scientific program consisted of 28 invited and 51 contributed talks and 60 posters. The Symposium provided a good opportunity to further discuss a strategy, based on acquired experience, for planning future surveys, and to coordinate follow-up observations with the new large ground-based and space telescopes. The IAU Symposium #304 was the 6th IAU meeting held in Armenia. The previous 5 meetings were held in 1966, 1986, 1989, 1998, and 2001.

### ***Viktor Ambartsumian: Life and Activities***

**Mickaelian, A. M.** (Yerevan, "Antares" Publ. House, 48 p., 2014)

The booklet is dedicated to the outstanding Armenian astronomer and one of the great scientists of the XX century Viktor Ambartsumian. He has fundamentally contributed in various fields of astronomy and astrophysics, cosmogony, theoretical physics, mathematics, and philosophy. Ambartsumian was a great organizer of science, important political and public figure. He was the Director of BAO in 1946-1988, the President of the Armenian Academy of Sciences in 1947-1993, the President of the International Astronomical Union (IAU) in 1961-1964 and the President of the International Council of Scientific Unions (ICSU) in 1968-1972.

### ***Astronomical Heritage in the National Culture***

**Harutyunian, H. A.; Mickaelian, A. M.; Parsamian, E. S.** (Astron. Heritage in the National Culture, Proc. Archaeoastronomical Meeting dedicated to Anania Shirakatsi's 1400<sup>th</sup> anniversary and ArAS XI Annual Meeting, 25-26 Sep 2012, Byurakan, Armenia. Yerevan, NAS RA "Gitutyun" Publ. House, 220 p., 2014)

The book contains Proceedings of the Archaeoastronomical Meeting "Astronomical Heritage in the National Culture" Dedicated to Anania Shirakatsi's 1400th Anniversary and XI Annual Meeting of the Armenian Astronomical Society. It consists of 3 main sections: "Astronomical Heritage", "Anania Shirakatsi" and "Modern Astronomy", as well as Literature about Anania Shirakatsi is included. The book may be interesting for astronomers, historians, archaeologists, linguists, students and other readers.

### ***The statistical investigation of the First and Second Byurakan survey galaxies and their neighbors***

**Nazaryan, T. A.** (PhD thesis, BAO, 158 p., 2014)

In the thesis we study close pairs of galaxies with the aim of understanding the influence of gravitational interaction on nuclear activity and star formation of paired galaxies. For this purpose we investigate dependences of integral parameters of galaxies, their star formation and properties of nuclei on kinematic parameters of systems and their large-scale environment. The thesis has an introduction, three main chapters, a summary, lists of abbreviations and references, and three appendices. In the first chapter, the methods of selection of sample of pairs of galaxies and measurements of physical parameters of the First Byurakan Survey (Markarian) galaxies and their neighbors are presented, and the databases in appendices A and B are described, which contain parameters of neighbors of Markarian galaxies measured by us, and the parameters of pairs having Markarian galaxies, based on the Sloan Digital Sky Survey (SDSS) data. The selection effects of sample of pairs are discussed, and the statistical comparison of Markarian galaxies and their neighbors is done. The results of statistical study of star formation and activity of nuclei in pairs having Markarian galaxies are presented, as well as the correlations between properties of galaxies in pairs and the physical mechanisms behind them. In the second chapter, the results of statistical study of the Second Byurakan Survey (SBS) galaxies and their neighbors, and star formation and activity of nuclei in those pairs are presented and discussed. In the third chapter, possibilities of using supernovae as indicators of star formation are discussed, the sample of supernovae in pairs of galaxies is presented, and study of star formation in pairs of interacting galaxies by means of that sample of supernovae is done. Also a conclusion about the nature of progenitors of different types of supernovae is made. The short summary of main results of the study concludes the thesis. Full manuscript of the Ph.D. thesis is in Armenian and consists of 158 pages, 22 figures, 6 tables, and 3 appendices. Defended on May 12, 2014 at the Byurakan Astrophysical Observatory (Armenia). Advisor: Artashes R. Petrosian.

## **Meetings and events held in Byurakan and Yerevan**

### **Armenian Astronomical School Olympiad, 05 Apr 2014, Byurakan**

The final stage of the annual astronomical contest for school pupils and selection of candidates for International Olympiad of Astronomy and Astrophysics (IOAA) and International Astronomical Olympiad (IAO). Chair of Jury: A.A. Akopian.

### **Visit of Foreign Ambassadors in Armenia to Byurakan, 30 May 2014, Byurakan**

The event was entitled “Ambassadors to the Universe” (having in the mind both astronomers as ambassadors to the Universe and ambassadors as guests of the observatory). The guests attended lectures by H.A. Harutyunian and by A.M. Mickaelian.

### **International Centre for Relativistic Astrophysics Network (ICRANet) meeting, 30 June – 04 July 2014, Yerevan**

A summer school (28-29 June) and international scientific conference dedicated to the issues of Relativistic Astrophysics “*Black Holes: the largest energy sources in the Universe*” were held at NAS RA, It was ICRANet first scientific meeting in Armenia.

### **Meeting “Relation of Astronomy to Other Sciences, Culture and Society” (RASCS) and ArAS XIII Annual Meeting, 7-10 Oct 2014, Byurakan**

This meeting was aimed at bringing together astronomers, philosophers, historians, archaeologists, philologists, artists, and representatives of other fields. It was combined with ArAS XIII annual meeting. Organizers: H.A. Harutyunian, A.M. Mickaelian, S.V. Farmanyan.

### **First Byurakan Science Camp (1BSC), 19-25 Oct 2014, Byurakan**

A science camp for 12-15 year-old pupils to get them acquainted to BAO, astronomy, and science in general. It was supported by Fund for Armenian Relief (FAR) and 25 pupils participated. Organizers: A.M. Mickaelian, S.V. Farmanyan.

### **Visit of Swiss Embassy in Armenia staff to Byurakan, 21 Nov 2014, Byurakan**

The guests got acquainted to BAO 2.6m telescope, Viktor Ambartsumian museum, and attended lectures by H.A. Harutyunian and by A.M. Mickaelian.

## **Research grants, honours and awards**

International research grants support the research at BAO and are a significant contribution compared to the low level of national funding. In 2014, following projects were active:

**ANSEF (2014):** “*Study of Supernovae and their host galaxies in the far ( $z \sim 0.3 - 0.6$ ) Universe*”, PI: **Artur Hakobyan**; “*X-ray properties of active galaxies*”, PI: **Areg Mickaelian**

**CNRS-SCS (2014-2015):** “*Abundance stratification, stellar oscillations and radiative transfer*”, PIs: **Haik Harutyunian** and **Georges Alecian** (*Observatoire de Paris-Meudon, France*)

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

**Thematic grants 2014-2015.** PIs: Tigran Magakian, Elena Nikoghosyan, and Artashes Petrosian

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

**ArAS Annual Prize for Young Astronomers (Yervant Terzian Prize) 2014:** Gurgen Paronyan

**Galileo Teacher Training Program (GTP) certificates:** A.A. Akopian, S.Ye. Nersisyan

## Foreign Missions

Altogether, **19 Byurakan scientists had 36 foreign missions to astronomical centres of 18 countries** (USA, UK, France, Germany, Italy, Switzerland, Czech Republic, Serbia, Romania, Bulgaria, Russia, Chile, Thailand, Tajikistan, Kyrgyzstan, UAE, Lebanon and Artsakh). As before, most active collaboration was with French institutions (altogether 7 visits by 6 scientists). Five times Armenian scientists visited Russia, three times Germany and Italy (each), twice – USA, Switzerland, Bulgaria and Artsakh (each). Out of the 36 visits, 14 have been accomplished for research work (France, USA, UK, Italy, Germany, and Chile), 8 for participation in meetings (including the European annual meeting EWASS-2014), 4 for schools, 5 for discussions of collaboration, 2 in international astronomical Olympiads (as the team supervisors), 2 for lectures, and 1 for participation in contest. Compared to recent years, 2014 was most productive for foreign missions both by the total number and number of countries visited (see the table).

#	Scientists	Institution and Country	Duration	Dates	Purpose
1	Vahagn Harutyunyan	Rome/Pescara, Italy	3 months	09.12.13-28.02.14	research
2	Haik Harutyunian	Rome/Pescara, Italy	1 week	01-07.02.2014	meeting
3	Haik Harutyunian	SAO, Russia	1 week	11-14.03.2014	collab.-n
4	Tigran Movsessian	SAO, Russia	1 week	11-14.03.2014	collab.-n
5	Areg Mickaelian	Prague, Czech Republic	1 week	17-24.03.2014	meeting
6	Vazgen Gabrielyan	Hartford, CT, USA	1 week	01-10.04.2014	contest
7	Knarik Khachatryan	Germany	2 weeks	10-25.04.2014	research
8	Ani Vardanyan	Germany	2 weeks	10-25.04.2014	research
9	Vazgen Gabrielyan	Germany	7 weeks	20.04-01.06.2014	research
10	Armen Gyulbudaghian	Santiago, Chile	2 months	25.04-25.06.2014	research
11	Anahit Samsonyan	Cornell Univ., N.Y., USA	5 weeks	08.05-13.06.2014	research
12	Artashes Petrosian	IAP, Paris, France	2 weeks	17.05-30.05.2014	research
13	Artur Hakobyan	IAP, Paris, France	2 weeks	01.06-15.06.2014	research
14	Gurgen Paronyan	Pulkovo Obs., Russia	1 week	05-12.06.2014	meeting
15	Areg Mickaelian	Geneva, Switzerland	1 week	29.06-04.07.2014	meeting
16	Elena Nikoghosyan	Geneva, Switzerland	1 week	30.06-05.07.2014	meeting
17	Kamo Gigoyan	Marseille, France	3 weeks	30.06-19.07.2014	research
18	Haik Harutyunian	Rome, Italy	1 week	03-05.07.2014	collab.-n
19	Areg Mickaelian	Paris, France	1 week	04-11.07.2014	research
20	Norair Melikian	United Kingdom	1 week	21-28.07.2014	research
21	Marietta Gyulzadyan	Suceava, Romania	1 week	01-11.08.2014	Olympiad
22	Anahit Samsonyan	Beirut, Lebanon	1 week	01-09.09.2014	meeting
23	Knarik Khachatryan	Rozhen Obs., Bulgaria	3 weeks	16.09-06.10.2014	school
24	Areg Mickaelian	Belgrade, Serbia	1 week	22-29.09.2014	meeting
25	Satenik Ghazaryan	Stepanakert, Artsakh	1 week	22-29.09.2014	lectures
26	Ani Vardanyan	Rozhen Obs., Bulgaria	2 weeks	24.09-06.10.2014	school
27	Gurgen Paronyan	Ak-Argali, Tajikistan	1 week	06-14.10.2014	school
28	Marietta Gyulzadyan	Bishkek, Kyrgyzstan	1 week	12-21.10.2014	Olympiad
29	Edward Khachikian	Saint Petersburg, Russia	1 week	14-18.10.2014	collab.-n
30	Tigran Movsessian	SAO, Russia	1 week	14-23.10.2014	collab.-n
31	Satenik Ghazaryan	Paris, France	2 weeks	17.10-01.11.2014	research
32	Satenik Ghazaryan	Stepanakert, Artsakh	1 week	02-06.11.2014	lectures
33	Haik Harutyunian	Paris, France	2 weeks	06-15.11.2014	research
34	Artur Hakobyan	Paris, France	2 weeks	09-22.11.2014	research
35	Naira Azatyan	Chiang Mai, Thailand	3 weeks	24.11-12.12.2014	school
36	Haik Harutyunian	Sharjah, UAE	1 week	08-12.12.2014	meeting

### **Comparison of foreign missions in 2009-2014:**

<b>Year</b>	<b>Visits</b>	<b>Scientists</b>	<b>Countries</b>
2014	36	19	18
2013	34	18	14
2012	35	21	14
2011	34	18	11
2010	33	17	13
2009	17	11	6

### **Visits of foreign scientists and other guests**

Altogether 21 astronomers, 30 other scientists and many other guests from 11 countries (USA, Germany, France, Italy, Spain, Portugal, Switzerland, Ireland, Colombia, Russia, and Georgia) visited Byurakan during 2014. 21 astronomers made 26 visits (Felix Aharonian, Georges Alecian, Serguei Dodonov, Massimo Turatto and Rafael Jonathan Camilo Vera Rodriguez visited twice).

Apr	<b>Georges Alecian</b> (OBSPM, France); collaboration
June	<b>Jorge Gomez Crespo</b> (Universidad de Santiago de Compostela, Spain); research, seminars
June	<b>Serguei Dodonov</b> (SAO, Russia); collaboration
June	<b>Yervant Terzian</b> (USA), <b>Felix Aharonian</b> (Ireland/Germany), <b>Jacques Boulesteix</b> (France), <b>Daniel Kunth</b> (France), <b>Michel Mayor</b> (Switzerland), <b>Massimo Turatto</b> (Italy), <b>Vahé Petrosian</b> (USA); BAO International Science Advisory Committee (ISAC) and Viktor Ambartsumian International Prize Steering Committee members
July	<b>Rafael Jonathan Camilo Vera Rodriguez</b> (Faculty of Science, Universidad Nacional de Colombia, Colombia); research, seminar
Aug	<b>Vardan Adibekyan</b> (CAUP, Portugal); seminar
Aug	<b>Tigran Arshakian</b> (1.Physikalisches Institut, Universität zu Köln, Germany); seminar
Sep	<b>Felix Aharonian</b> (Ireland/Germany), <b>Igor Karachentsev</b> (Russia), <b>Brent Tully</b> (USA); Viktor Ambartsumian International Prize Winners, for Award Ceremony
Sep	<b>Georges Alecian</b> (OBSPM, France); collaboration
Oct	<b>Valery Vardanyan</b> (Jena, Germany), <b>Samvel Poghosyan</b> (Georgia), <b>Mariam Khachatryan</b> (France); participation in "Relation of Astronomy to other Sciences, Culture and Society" meeting
Nov	<b>Massimo Turatto</b> (Padova Observatory, Italy); seminar
Nov	<b>Alain Sarkissian</b> , <b>Mustapha Meftah</b> , <b>Abdanour Irbah</b> (LATMOS, France); collaboration, seminar
Dec	<b>Serguei Dodonov</b> (SAO, Russia); collaboration
Dec	<b>Rafael Jonathan Camilo Vera Rodriguez</b> (Faculty of Science, Universidad Nacional de Colombia, Colombia); research, seminar

Jan-Dec 30 Russian team members working on Cosmic Debris project in collaboration with BAO.

### **Participation in Meetings**

During 2014, Byurakan astronomers have participated in 16 meetings, including a number of important international ones, such as the EWASS-2014 meeting in Geneva, Switzerland, as well as other meetings in Italy, Russia, Czech Republic, Serbia, UAE and Lebanon, astronomical schools in

Bulgaria, Thailand and Tajikistan, International Astronomical Olympiads in Romania and Kyrgyzstan, as well as meetings and seminars in Yerevan and Byurakan: RASCS, ICRANet, BSC, and National Olympiad. The list contains 4 meetings in Armenia and 12 meetings abroad.

**Governing Committee Meeting of the International Centre for Relativistic Astrophysics Network (ICRANet)**, 3-7 Feb 2014, Rome/Pescara, Italy (Haik Harutyunian)

**AstroPlate2014**: *“International workshop on scientific use, digitization and preserving astronomical photographic records”*, 18-21 Mar 2014, Prague, Czech Republic (Areg Mickaelian)

**Armenian Astronomical School Olympiad**, 5 Apr 2014, Byurakan, Armenia (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)

**5<sup>th</sup> International Conference for Young Astronomers**, dedicated to the 175<sup>th</sup> anniversary of Principal Astronomical Observatory of the Russian Academy of Sciences, 9-11 June 2014, Pulkovo Observatory, Saint Petersburg, Russia (Gurgen Paronyan)

**European Week of Astronomy and Space Science 2014 (EWASS-2014)**, 30 June – 4 July 2014, Geneva, Switzerland; Symposium #1 and Special Meeting (SM) #3 (Areg Mickaelian, Elena Nikoghosyan, and Tigran Arshakian from Germany)

**International Centre for Relativistic Astrophysics Network (ICRANet) meeting**, 30 June – 4 July 2014, Yerevan, Armenia (Haik Harutyunian)

**8<sup>th</sup> International Olympiad on Astronomy and Astrophysics (IOAA)**, 1-10 Aug 2014, Romania (Marietta Gyulzadian)

**3<sup>rd</sup> Middle East and Africa Regional IAU Meeting 2014 (MEARIM-2014)**, 1-6 Sep 2014, Beirut, Lebanon (Anahit Samsonyan)

**17<sup>th</sup> National Conference of Astronomers of Serbia (NCAS)**, 23-27 Sep 2014, Belgrade, Serbia (Areg Mickaelian)

**NEON (Network of European Observatories in the North) observing school and Awareness Conference**, 17 Sep – 1 Oct 2014, Rozhen Observatory, Bulgaria (Knarik Khachatryan, Ani Vardanyan)

**International School for Young Astrophysicists of CIS countries**, 6-14 Oct 2014, Ak-Argali, Tajikistan (Gurgen Paronyan)

**Meeting “Relation of Astronomy to Other Sciences, Culture and Society” (RASCS) and ArAS XIII Annual Meeting**, 7-10 Oct 2014, Byurakan, Armenia (BAO staff members)

**19<sup>th</sup> International Astronomical Olympiad (IAO)**, 12-21 Oct 2014, Bishkek and Cholpon-Ata, Kyrgyzstan (Marietta Gyulzadian)

**First Byurakan Science Camp (1BSC)**, 19-25 Oct 2014, Byurakan, Armenia (A.M. Mickaelian, S.V. Farmanyanyan, H.V. Abrahamyan, H.A. Harutyunian, E.S. Parsamian, E.H. Nikoghosyan)

**IAU International School for Young Astronomers 2014 (ISYA-2014)**, 24 Nov – 12 Dec 2014, Chiang Mai, Thailand (Naira Azatyan)

**11<sup>th</sup> Conference of the Arab Union for Space and Astronomy Sciences**, held in frame of the 2<sup>nd</sup> International Conference of Arabs' and Muslims' History of Science, 8-11 Dec 2014, Sharjah, UAE (Haik Harutyunian)

### Talks, posters and lectures presented at meetings and schools

During 2014, Byurakan astronomers presented invited, oral and poster contributions at 8 meetings held in 8 countries (Switzerland, Czech Republic, Serbia, Russia, Tajikistan, UAE, Lebanon, and Armenia) and gave lectures at the 1<sup>st</sup> Byurakan Science Camp (1BSC). Altogether, there were **7 invited talks, 17 contributed talks, 2 posters, 9 lectures and 1 report**.

**AstroPlate2014**, 18-21 Mar 2014, Prague, Czech Republic (1 oral talk)

A.M. Mickaelian: *Byurakan Astrophysical Observatory plate archive and its scientific usage* (oral talk)

**5<sup>th</sup> International Conference for Young Astronomers**, 9-11 June 2014, Pulkovo Observatory, Russia (1 oral talk)

G.M. Paronyan: *Multiwavelength investigation of X-ray selected AGN (Homogeneous catalogue of X-ray AGN)* (oral talk)

**EWASS-2014**, 30 June – 4 July 2014, Geneva, Switzerland (1 oral talk, 2 posters)

**Symposium #1: Star formation in galaxies: from small to large scales:**

A.M. Mickaelian: *Star formation rates and starburst activity in Byurakan-IRAS Galaxy (BIG) sample* (poster)

E.H. Nikogosian, N. Azatyan: *The Young Stellar Cluster in the Vicinity of the IRAS 05137+3919 Source* (poster)

**Special Meeting (SM) #3: Inter-, multi- and transdisciplinarity in astronomical education:**

A.M. Mickaelian: *Introducing inter-, multi- and transdisciplinarity in astronomical education in Armenia* (oral talk)

**3<sup>rd</sup> Middle East and Africa Regional IAU Meeting 2014 (MEARIM-2014)**, 1-6 Sep 2014, Beirut, Lebanon (1 oral talk)

A. Samsonyan: *[CII] 157  $\mu$ m Emission line in Dusty Starbursts* (oral talk)

**17<sup>th</sup> National Conference of Astronomers of Serbia (NCAS)**, 23-27 Sep 2014, Belgrade, Serbia (2 oral talks)

A.M. Mickaelian: *Regional Activities related to IAU Strategic Plan and Integration of Armenia in the European Astronomy* (oral talk)

A.M. Mickaelian, S.V. Farmanyan: *Cultures across the sky and the roots of Armenian astronomy* (oral talk)

**International School for Young Astrophysicists of CIS countries**, 6-14 Oct 2014, Ak-Argali, Tajikistan (1 oral talk)

G.M. Paronyan: *Multiwavelength investigation of X-ray active galactic nuclei in the HQS region* (oral talk)

**Meeting “Relation of Astronomy to Other Sciences, Culture and Society” (RASCS) and ArAS XIII Annual Meeting**, 7-10 Oct 2014, Byurakan, Armenia (6 invited talks, 10 oral talks and 1 report)

A.M. Mickaelian: *Astronomy as the Leader of Interdisciplinary and Multidisciplinary Sciences* (invited talk)

Ar.G. Yeghikian: *Is the Universe always was a convenient place for the life origin?* (invited talk)

A.M. Mickaelian: *The Problem of Extraterrestrial Civilizations and Extrasolar Planets* (oral talk)

H.V. Pikichian: *An Application of the Cosmologic Concepts and Astronomical Symbols in the Ancient Medical Science and Astrology Systems* (invited talk)



G.H. Brutian: *The ancient Armenian calendars' connection with the celestial bodies* (invited talk)  
 H.A. Harutyunian: *Astronomical terms and names as an indicator of the science level* (invited talk)  
 Ar.G. Yeghikian: *Astrophysical terms in Armenian* (oral talk)  
 A.M. Mickaelian, A.E. Grigoryan: *Dangerous Near-Earth Asteroids and Meteorites* (oral talk)  
 E.H. Nikoghosyan: *The Ecology of Near-Earth Space Environment* (oral talk)  
 A.M. Mickaelian, H.V. Astsatryan: *Computational Methods in Astrophysics* (oral talk)  
 A.M. Mickaelian: *Armenian Virtual Observatory* (invited talk)  
 H.A. Harutyunian: *On a Possibility of Astrostatistics Methods' Application in the Literature* (oral talk)  
 S.V. Farmanyan, A.M. Mickaelian: *Scientific Journalism in Armenia* (oral talk)  
 M.V. Gyulzadyan: *Astronomy Teaching Problems in Armenia* (oral talk)  
 A.A. Yeghiazaryan: *Astrology: Science, Art or Prophecy* (oral talk)  
 S.V. Farmanyan, A.M. Mickaelian: *Astroheraldry* (oral talk)  
 A.M. Mickaelian: *Armenian Astronomical Society Annual Activities in 2014* (report)

**First Byurakan Science Camp (1BSC), 19-25 Oct 2014, Byurakan, Armenia (9 lectures)**

A.M. Mickaelian: *The role of science for human society* (lecture)  
 H.A. Harutyunian: *Viktor Ambartsumian and Byurakan Astrophysical Observatory* (lecture)  
 E.S. Parsamian: *Archaeoastronomy in Armenia* (lecture)  
 A.M. Mickaelian: *Our understanding of the Universe* (lecture)  
 H.V. Abrahamyan: *Solar System* (lecture)  
 E.H. Nikoghosyan: *In the World of Stars and Nebulae* (lecture)  
 A.M. Mickaelian: *Galaxies and Cosmology* (lecture)  
 A.M. Mickaelian: *Problems of Extraterrestrial Civilizations and Exoplanets* (lecture)  
 A.M. Mickaelian: *Astronomy and Astrology* (lecture)

**11<sup>th</sup> Conference of the Arab Union for Space and Astronomy Sciences, 8-11 Dec 2014, Sharjah, UAE (1 invited talk)**

H.A. Harutyunian: *On the Radial Velocities of Dwarf Galaxies – Members of Virgo Cluster* (invited talk)

**Seminars**

Date	Speakers	Institution, country	Topic
10.02	Artur Nikoghossian	BAO, Armenia	Groups and their representations in radiative scattering theory
17.02	Gagik Ter-Kazarian	BAO, Armenia	Ultra-high energy phenomena in the Universe (observational material) – resolving the controversy between Black Hole and superdense matter hypotheses
24.02	Gagik Ter-Kazarian	BAO, Armenia	Growth and lifetime of black hole seeds and neutrino radiation in active galactic nuclei and ultra-high energy cosmic rays
10.03	Gurgen Paronyan	BAO, Armenia	Current state of BAO plate archive and possible science projects
17.03	Edward Khachikian	BAO, Armenia	On some properties of active galaxies
26.03	Areg Mickaelian, Gurgen Paronyan	BAO, Armenia	X-ray properties of galaxies
09.06	Jorge Gomez Crespo	Univ. de Santiago de Compostela, Spain	Introduction to IRAF
16.06	Hayk Abrahamyan	BAO, Armenia	Radio properties of AGN

30.06	Jorge Gomez Crespo	Univ. de Santiago de Compostela, Spain	Data reduction by IRAF
21.07	Rafael J. Camilo Vera Rodriguez	Univ. Nacional de Colombia	SQL in databases of Astronomy
21.07	Jorge Gomez Crespo	Univ. de Santiago de Compostela, Spain	Photometry with IRAF
11.08	Vardan Adibekyan	CAUP, Portugal	The role of metallicity in formation and evolution of planets
19.08	Artur Karapetyan	BAO, Armenia	Search and study of emission objects in star-forming regions
25.08	Tigran Arshakian	1. Phys. Inst., Univ. zu Köln, Germany	Wavelet cross-correlation as a tool to study scale dependent structural changes in molecular clouds
27.10	Rafael J. Camilo Vera Rodriguez	Univ. Nacional de Colombia	The ionization continuum in forbidden high-ionization lines (FHIL) Seyfert galaxies
03.11	Massimo Turatto	Padova Observatory, Italy	Current Supernovae Surveys
03.11	Alain Sarkissian, Mustapha Meftah	LATMOS, France	The PICARD space mission

## Publications

During 2014, Byurakan astronomers had 69 publications: **27 papers in 8 refereed journals** (including 16 in *Astrophysics*, 3 in *ApJ*, 3 in *A&A*, 1 in *MNRAS*, 1 in *Astrophysics and Space Science*, 1 in *Journal of Astrophysics*, 1 in *Astronomy and Computing*, and 1 in *Physics Research International*), **35 in proceedings of 3 meetings** (including 23 in *Proc. IAU Symp. #304*, 10 in *Proc. Archaeoastronomical Meeting*, and 2 in *Proc. AstroPlate2014*), **2 electronic catalogues**, **3 books** (including *Proc. IAU Symposium #304: Multiwavelength AGN Surveys and Studies* held in 2013, *Proc. Archaeoastronomical Meeting: Astronomical Heritage in the National Culture* held in 2012 and the booklet “*Viktor Ambartsumian: Life and Activities*” by A.M. Mickaelian), **1 PhD thesis** by T.A. Nazaryan, and **1 paper in Circular**, as well as **3 preprints** that will be published as papers and **12 abstracts** of papers presented at meetings. Numerous information materials and popular articles were published as well. Compared to 2013, the number of refereed papers is slightly less, but there is significant increase in proceedings papers and other publications. The characteristic feature of BAO publications in 2014 is that 38 authors have at least one publication, which is much higher number of authors compared to previous years, when many researchers were rather passive. This was particularly due to the Proceedings of IAU Symposium #304.

## Refereed Journals (27)

Morel, T.; Briquet, M.; Auvergne, M.; Alecian, G.; **Ghazaryan, S.**; Niemczura, E.; Fossati, L.; Lehmann, H.; Hubrig, S.; Ulusoy, C.; Damerdji, Y.; Rainer, M.; Poretti, E.; Borsari, F.; Scardia, M.; Schmid, V. S.; Van Winckel, H.; De Smedt, K.; Pápics, P. I.; Gameiro, J. F.; Waelkens, C.; Fagas, M.; Kamiński, K.; Dimitrov, W.; Baglin, A.; Michel, E.; Dumortier, L.; Frémat, Y.; Hensberge, H.; Jorissen, A.; Van Eck, S. – *A search for pulsations in the HgMn star HD 45975 with CoRoT photometry and ground-based spectroscopy* // *Astronomy & Astrophysics*, Vol. 561, id.A35, 14 p., 01/2014

Mauron, N.; **Gigoyan, K. S.**; Berlioz-Arthaud, P.; Klotz, A. – *Cool carbon stars in the halo and in dwarf galaxies: Ha, colours, and variability* // *Astronomy & Astrophysics*, Vol. 562, id.A24, 37 p., 02/2014

**Ter-Kazarian, G.** – *Ultra-high energy neutrino fluxes from supermassive AGN black holes* // *Astrophysics and Space Science*, Vol. 349, No. 2, p. 919-938, 02/2014

**Nazaryan, T. A.; Petrosian, A. R.; Hakobyan, A. A.; McLean, B. J.; Kunth, D.** – *Close Neighbors of Markarian Galaxies. II. Statistics and Discussions* // *Astrophysics*, Vol. 57, No. 1, p. 14-29, 03/2014

**Nazaryan, T. A.** – *The Second Byurakan Survey Galaxies in Close Pairs* // *Astrophysics*, Vol. 57, No. 1, p. 50-58, 03/2014

**Melikian, N. D.** – *Spectra of Stellar Flares. Continuum Emission* // *Astrophysics*, Vol. 57, No. 1, p. 77-89, 03/2014

**Ghazaryan, S.** – *Physical and Chemical Parameters of HgMn Stars Based on Available Data* // *Astrophysics*, Vol. 57, No. 1, p. 159-162, 03/2014

**Batista, S. F. A.; Adibekyan, V. Zh.; Sousa, S. G.; Santos, N. C.; Delgado Mena, E.; Hakobyan, A. A.** – *Searching for solar siblings among the HARPS data* // *Astronomy & Astrophysics*, Vol. 564, id.A43, 4 p., 04/2014

**Cohen, M. H.; Meier, D. L.; Arshakian, T. G.; Homan, D. C.; Hovatta, T.; Kovalev, Y. Y.; Lister, M. L.; Pushkarev, A. B.; Richards, J. L.; Savolainen, T.** – *Studies of the Jet in BL Lacertae. I. Recollimation Shock and Moving Emission Features* // *The Astrophysical Journal*, Vol. 787, No. 2, article id. 151, 10 p., 06/2014

**Gyulbudaghian, A. L.** – *The Star-Formation Region SNO 87* // *Astrophysics*, Vol. 57, No. 2, p. 213-220, 06/2014

**Movsessian, T. A.; Magakian, T. Yu.** – *HH 1050: A Bipolar Flow in the Cloud L 988* // *Astrophysics*, Vol. 57, No. 2, p. 231-240, 06/2014

**Nikoghossian, A. G.** – *Groups and their Representations in the Theory of Radiative Transfer. I* // *Astrophysics*, Vol. 57, No. 2, p. 272-286, 06/2014

**Sargsyan, L.; Samsonyan, A.; Lebouteiller, V.; Weedman, D.; Barry, D.; Bernard-Salas, J.; Houck, J.; Spoon, H.** – *Star Formation Rates from [C III] 158  $\mu$ m and Mid-infrared Emission Lines for Starbursts and Active Galactic Nuclei* // *The Astrophysical Journal*, Vol. 790, No. 1, article id. 15, 12 p., 07/2014

**Vardanyan, V.; Weedman, D.; Sargsyan, L.** – *Seeking the Epoch of Maximum Luminosity for Dusty Quasars* // *The Astrophysical Journal*, Vol. 790, No. 2, article id. 88, 12 p., 08/2014

**Nikoghosyan, E. H.; Azatyan, N.** – *Young Stellar Cluster in the Vicinity of the IRAS 05137+3919 Source* // *Astrophysics*, Vol. 57, No. 3, p. 330-343, 09/2014

**Hakopian, S. A.** – *Study of SBS 1202+583. Features of the Radial Velocity Distribution over the Field* // *Astrophysics*, Vol. 57, No. 3, p. 352-358, 09/2014

**Abrahamyan, H. V.; Andreasyan, R. R.; Hovhannisyan, M. A.; Paronyan, G. M.** – *Study of Compact Radio Galaxies in the 7C II Field* // *Astrophysics*, Vol. 57, No. 3, p. 359-369, 09/2014

**Nikoghossian, A. G.** – *Groups and Their Representations in the Theory of Radiative Transfer. II* // *Astrophysics*, Vol. 57, No. 3, p. 375-383, 09/2014

**Hakobyan, A. A.; Nazaryan, T. A.; Adibekyan, V. Zh.; Petrosian, A. R.; Aramyan, L. S.; Kunth, D.; Mamon, G. A.; de Lapparent, V.; Bertin, E.; Gomes, J. M.; Turatto, M.** – *Supernovae and their host galaxies - II. The relative frequencies of supernovae types in spirals* // *Monthly Notices of the Royal Astronomical Society*, Vol. 444, No. 3, p. 2428-2441, 11/2014

**Kogoshvili, N. G.; Borchkhadze, T. M.; Kalloghlian, A. T.** – *Distribution of Spiral Galaxies in the Virgo and Fornax Clusters and Their Dynamic Features* // *Astrophysics*, Vol. 57, No. 4, p. 473-483, 12/2014

**Harutyunian, H. A.; Harutyunyan, V. S. – Is it Possible to Find Signs of the Evolution of Anomalous Redshift by Studying Galaxies in a Single Cluster? // Astrophysics, Vol. 57, No. 4, p. 484-490, 12/2014**

**Melikian, N. D.; Gomez, J.; Karapetian, A. A. – New H $\alpha$  Emission Stars in Cep OB3 Region. A Rapid Brightness Variation of V 733 Cep // Astrophysics, Vol. 57, No. 4, p. 500-509, 12/2014**

**Gigoyan, K. S.; Sarkissian, A.; Russeil, D.; Mauron, N.; Kostandyan, G.; Vartanian, R.; Abrahamyan, H. V.; Paronyan, G. M. – Investigation of Faint Galactic Carbon Stars from the First Byurakan Spectral sky Survey. Optical Variability. I. N-Type AGB Carbon Stars. K-band Absolute Magnitudes and Distances // Astrophysics, Vol. 57, No. 4, p. 510-519, 12/2014**

**Gyulbudaghian, A. L.; Mendez, R. A. – New Radial Systems of Dark Globules and HH Objects // Astrophysics, Vol. 57, No. 4, p. 520-529, 12/2014**

**Abrahamyan, H. V.; Mickaelian, A. M.; Knyazyan, A. V. – The IRAS PSC/FSC Combined Catalogue // Astronomy and Computing, Online publication, 12/2014**

**Ter-Kazarian, G. T. – Growth of Accreting Supermassive Black Hole Seeds and Neutrino Radiation // Journal of Astrophysics, Article ID 205367, 2014**

**Ter-Kazarian, G. T. – Modified Theories of Gravitation behind the Spacetime Deformation // Physics Research International, Article ID 152846, 2014**

### **Proceedings of Meetings (35)**

**Mickaelian, A. M. – Markarian survey and Markarian galaxies // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 1-10, 07/2014**

**Gyulzadyan, M. V.; Adibekyan, V. Z. – The physical conditions and oxygen and nitrogen abundance of 36 SBS galaxies from the SDSS DR7 // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 34-35, 07/2014**

**Hakopian, S. – Complex Investigation of SBS Galaxies in Seven Selected Fields // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 36-36, 07/2014**

**Mickaelian, A. M.; Abrahamyan, H. V.; Harutyunyan, G. S.; Paronyan, G. M. – Revised activity types for Markarian galaxies // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 41-42, 07/2014**

**Harutyunyan, G. S.; Mickaelian, A. M. – Analysis and Statistics of the Spectroscopic Sample of Byurakan-IRAS Galaxies // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 68-69, 07/2014**

**Abrahamyan, H. V.; Mickaelian, A. M. – Investigation of Extragalactic Radio Sources by Cross-Matching of Radio Catalogs // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 100-101, 07/2014**

**Abrahamyan, H. V.; Mickaelian, A. M. – Radio Properties of AGN // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 102-103, 07/2014**

**Andreasyan, R.; Hovhannisyanyan, M.; Paronyan, G.; Abrahamyan, H. – Study of some morphological features of extragalactic radio sources of FRI and FRII types // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 104-105, 07/2014**

**Paronyan, G. M.; Mickaelian, A. M.; Abrahamyan, H. V. – Study of a homogeneous X-ray selected AGN sample // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 161-163, 07/2014**

- Paronyan, G. M.; Abrahamyan, H. V.; Harutyunyan, G. S.; Mickaelian, A. M.** – *The ROSAT/NVSS AGN sample // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 164-165, 07/2014*
- Paronyan, G. M.; Harutyunyan, G. S.; Mickaelian, A. M.** – *Activity types for X-ray candidate AGN from SDSS // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 166-167, 07/2014*
- Hovhannisyan, M.; Andriasyan, R.; Paronyan, G.; Abrahamyan, H.** – *Investigation of Distant Quasars // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 236-237, 07/2014*
- Arshakian, T. G.; Chavushyan, V.** – *The central pc-scale region in blazars: insights from multi-band observations // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 257-260, 07/2014*
- Nazaryan, T. A.; Petrosian, A. R.; Hakobyan, A. A.; McLean, B. J.; Kunth, D.** – *Close pairs of galaxies with different activity levels // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 327-330, 07/2014*
- Amirkhanian, A. S.; del Olmo, A.; Egikian, A. G.; Tiersch, H.; Stoll, D.; Perea, J.** – *AGN populations in compact groups of galaxies // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 337-338, 07/2014*
- Hakobyan, A. A.; Nazaryan, T. A.; Adibekyan, V. Zh.; Petrosian, A. R.; Aramyan, L. S.; Kunth, D.; Mamon, G. A.; de Lapparent, V.; Bertin, E.; Gomes, J. M.; Turatto, M.** – *Relative frequencies of supernovae versus properties of spiral hosts // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 339-340, 07/2014*
- Nazaryan, T. A.; Petrosian, A. R.; Hakobyan, A. A.; Adibekyan, V. Zh.; Kunth, D.; Mamon, G. A.; Turatto, M.; Aramyan, L. S.** – *Supernovae in paired galaxies // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 351-352, 07/2014*
- Terzian, Y.; Khachikian, E.** – *Galaxies with Binary Nuclei // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 363-370, 07/2014*
- Harutyunyan, G. S.; Mickaelian, A. M.** – *Study of Starburst/Activity/Interaction Phenomena based on the Multiple Byurakan-IRAS Galaxies // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 383-384, 07/2014*
- Harutyunian, H. A.** – *Are the “Physically Bound Systems” beyond the Cosmological Expansion Effect? (A provocative musing on the given theme) // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 391-394, 07/2014*
- Hakopian, S. A.; Balayan, S. K.; Movsessian, T. A.** – *Results on Panoramic Spectroscopy of Mrk 171 // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 411-412, 07/2014*
- Ohanian, G. A.** – *The Role of Radio Loud Phase of Nuclear Activity in Galaxy Formation and Evolution // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 419-420, 07/2014*
- Mickaelian, A. M.** – *60 years of IAU symposia // Multiwavelength AGN Surveys and Studies, Proc. IAU Symposium, Vol. 304, p. 432-433, 07/2014*
- Parsamian, E. S.** – *Archaeoastronomy in Armenia // Astronomical Heritage in the National Culture, Proc. Archaeoastronomical Meeting dedicated to Anania Shirakatsi's 1400th anniversary and ArAS XI Annual Meeting, held 25-26 September 2012 in Byurakan, Armenia. Yerevan, NAS RA "Gitutyun" Publishing House, p. 12-22, 10/2014*
- Harutyunian, H. A.** – *Armenian Vahagn God as birth of four Cosmic elements // Astronomical Heritage in the National Culture, Proc. Archaeoastronomical Meeting dedicated to Anania Shirakatsi's 1400th anniversary and ArAS XI Annual Meeting, held 25-26 September 2012 in Byurakan, Armenia. Yerevan, NAS RA "Gitutyun" Publishing House, p. 23-28, 10/2014*

Farmanyan, S. V.; Mickaelian, A. M. – *Sun and Sun Worship in Different Cultures* // *Astronomical Heritage in the National Culture, Proc. Archaeoastronomical Meeting dedicated to Anania Shirakatsi's 1400th anniversary and ArAS XI Annual Meeting, held 25-26 September 2012 in Byurakan, Armenia. Yerevan, NAS RA "Gitutyun" Publishing House, p. 36-43, 10/2014*

**Mickaelian, A. M.** – *Armenian Astronomical Heritage* // *Astronomical Heritage in the National Culture, Proc. Archaeoastronomical Meeting dedicated to Anania Shirakatsi's 1400th anniversary and ArAS XI Annual Meeting, held 25-26 September 2012 in Byurakan, Armenia. Yerevan, NAS RA "Gitutyun" Publishing House, p. 44-55, 10/2014*

**Harutyunian, H. A.; Mickaelian, A. M.** – *Anania Shirakatsi's Cosmographical Works and the Methodology of his Natural Science* // *Astronomical Heritage in the National Culture, Proc. Archaeoastronomical Meeting dedicated to Anania Shirakatsi's 1400th anniversary and ArAS XI Annual Meeting, held 25-26 September 2012 in Byurakan, Armenia. Yerevan, NAS RA "Gitutyun" Publishing House, p. 87-97, 10/2014*

**Harutyunyan, G. S.** – *Shirakatsi Crater on the Moon* // *Astronomical Heritage in the National Culture, Proc. Archaeoastronomical Meeting dedicated to Anania Shirakatsi's 1400th anniversary and ArAS XI Annual Meeting, held 25-26 September 2012 in Byurakan, Armenia. Yerevan, NAS RA "Gitutyun" Publishing House, p. 158-159, 10/2014*

**Mickaelian, A. M.; Mikayelyan, G. A.** – *Anania Shirakatsi's Webpage* // *Astronomical Heritage in the National Culture, Proc. Archaeoastronomical Meeting dedicated to Anania Shirakatsi's 1400th anniversary and ArAS XI Annual Meeting, held 25-26 September 2012 in Byurakan, Armenia. Yerevan, NAS RA "Gitutyun" Publishing House, p. 160-164, 10/2014*

**Mickaelian, A. M.** – *Popular Astronomy in the World and in Armenia* // *Astronomical Heritage in the National Culture, Proc. Archaeoastronomical Meeting dedicated to Anania Shirakatsi's 1400th anniversary and ArAS XI Annual Meeting, held 25-26 September 2012 in Byurakan, Armenia. Yerevan, NAS RA "Gitutyun" Publishing House, p. 168-184, 10/2014*

**Gyulzadyan, M. V.** – *Armenian Pupils in the International Olympiads* // *Astronomical Heritage in the National Culture, Proc. Archaeoastronomical Meeting dedicated to Anania Shirakatsi's 1400th anniversary and ArAS XI Annual Meeting, held 25-26 September 2012 in Byurakan, Armenia. Yerevan, NAS RA "Gitutyun" Publishing House, p. 185-189, 10/2014*

**Mickaelian, A. M.** – *Achievements of the Armenian Astronomy and the Present Activities of the Armenian Astronomical Society* // *Astronomical Heritage in the National Culture, Proc. Archaeoastronomical Meeting dedicated to Anania Shirakatsi's 1400th anniversary and ArAS XI Annual Meeting, held 25-26 September 2012 in Byurakan, Armenia. Yerevan, NAS RA "Gitutyun" Publishing House, p. 198-212, 10/2014*

Nesci, R.; Gaudenzi, S.; Rossi, C.; Pezzotti, C.; **Gigoyan, K.**; Mauron, N. – *AGB stars and the plate archives heritage* // *Proc. Astroplate 2014: International Workshop on Scientific Use, Digitization and Preserving Astronomical Photographic Records, 18-21 Mar 2014, Prague, Czech Republic, Eds.: L. Miskova, S. Vitek, Institute of Chemical Technology, Prague, Czech Republic, p. 91-94, 12/2014*

**Mickaelian, A. M.** – *Byurakan Astrophysical Observatory plate archive and its scientific usage* // *Proc. of Astroplate 2014: International Workshop on Scientific Use, Digitization and Preserving Astronomical Photographic Records, 18-21 Mar 2014, Prague, Czech Republic, Eds.: L. Miskova, S. Vitek, Institute of Chemical Technology, Prague, Czech Republic, p. 109-114, 12/2014*

## **Electronic Catalogs (2)**

Mauron, N.; **Gigoyan, K. S.**; Berlioz-Arthaud, P.; Klotz, A. – *Cool carbon stars in the halo and Fornax dSph (Mauron+, 2014)* // *VizieR On-line Data Catalog: J/A+A/562/A24. Originally published in: 2014A&A...562A..24M, 03/2014*

Torrealba, J.; Chavushyan, V.; Cruz-Gonzalez, I.; **Arshakian, T. G.**; Bertone, E.; Rosa-Gonzalez, D. – *MOJAVE/2cm AGN sample opt. spectros. atlas (Torrealba+, 2012)* // *VizieR On-line Data Catalog: J/other/RMxAA/48.9*. Originally published in: 2012RMxAA..48....9T, 09/2014

### **Books, Theses (3+1)**

**Mickaelian, A. M.**; Sanders, D. B. (Eds.) – *Multiwavelength AGN Surveys and Studies* // *Proc. IAU Symposium #304: Multiwavelength AGN Surveys and Studies, Cambridge, Cambridge University Press (CUP), 437 p., 07/2014*

**Mickaelian, A. M.** – *Viktor Ambartsumian: Life and Activities* // Yerevan, "Antares" Publishing House, 48 p., 09/2014

**Harutyunian, H. A.**; **Mickaelian, A. M.**; **Parsamian, E. S.** (Eds.) – *Astronomical Heritage in the National Culture* // *Astronomical Heritage in the National Culture, Proc. Archaeoastronomical Meeting dedicated to Anania Shirakatsi's 1400th anniversary and ArAS XI Annual Meeting, held 25-26 September 2012 in Byurakan, Armenia. Yerevan, NAS RA "Gitutyun" Publishing House, 220 p., 10/2014*

**Nazaryan, T. A.** – *The statistical investigation of the First and Second Byurakan survey galaxies and their neighbors* // *Ph.D. thesis, Byurakan, 158 p., 05/2014*

### **Other (1)**

Pozanenko, A.; Romas, E.; Nevskiy, V.; **Ohanian, G.**; **Andreasyan, H.**; Volnova, A.; Molotov, I. – *GRB 140818B: ISON-Kislovodsk and ISON-Burakan optical upper limit* // *GRB Coordinates Network, Circular Service, 16728, 1, 00/2014*

### **Preprints (3)**

Nesci, R.; Gaudenzi, S.; Rossi, C.; Pezzotti, C.; **Gigoyan, K.**; Mauron, N. – *AGB stars and the plate archives heritage* // *eprint arXiv:1404.3842, 04/2014*

Cohen, M. H.; Meier, D. L.; **Arshakian, T. G.**; Clausen-Brown, E.; Homan, D. C.; Hovatta, T.; Kovalev, Y. Y.; Lister, M. L.; Pushkarev, A. B.; Richards, J. L.; Savolainen, T. – *Studies of the Jet in BL Lacertae. II. Superluminal Alfvén Waves* // *eprint arXiv:1409.3599 (accepted in ApJ), 09/2014*

Richards, J. L.; Lister, M. L.; Savolainen, T.; Homan, D. C.; Kadler, M.; Hovatta, T.; Readhead, A. C. S.; **Arshakian, T. G.**; Chavushyan, V. – *The Parsec-scale Structure, Kinematics, and Polarization of Radio-Loud Narrow-Line Seyfert 1 Galaxies* // *eprint arXiv:1411.1058 (accepted in Proc. IAU S313), 11/2014*

### **Abstracts (12)**

Richards, J. L.; Lister, M. L.; Foschini, L.; Savolainen, T.; Homan, D. C.; Kadler, M.; Hovatta, T.; Readhead, A. C.; **Arshakian, T.**; Chavushyan, V. – *The Parsec-scale Structure and Kinematics of Radio-Loud Narrow-Line Seyfert 1 Galaxies* // *American Astronomical Society, AAS Meeting #223, #251.01, 01/2014*

**Mickaelian, A. M.** – *Star formation rates and starburst activity in Byurakan-IRAS Galaxy (BIG) sample* // *EWASS-2014 Abstract Book, Geneva, Switzerland, 06/2014*

**Nikoghosyan, E. H.**; **Azatyanyan, N.** – *The Young Stellar Cluster in the Vicinity of the IRAS 05137+3919 Source* // *EWASS-2014 Abstract Book, Geneva, Switzerland, 06/2014*

**Mickaelian, A. M.** – *Introducing inter-, multi- and transdisciplinarity in astronomical education in Armenia* // *EWASS-2014 Abstract Book, Geneva, Switzerland, 06/2014*

Richards, J. L.; Lister, M. L.; Foschini, L.; Savolainen, T.; Homan, D. C.; Kadler, M.; Readhead, A. C. S.; **Arshakian, T.**; Chavushyan, V. – *The Parsec-scale Structure and Kinematics of Radio-Loud Narrow-Line Seyfert 1 Galaxies* // *American Astronomical Society, HEAD meeting #14, #106.08, 08/2014*

**Samsonyan, A.** – *[CII] 157  $\mu\text{m}$  Emission line in Dusty Starbursts* // *3rd Middle East and Africa Regional IAU Meeting 2014 (MEARIM-2014), Abstract Book, Beirut, Lebanon, 09/2014*

**Harutyunian, H. A.** – *Bilinear decomposition of redistribution function* // *Fifth Russian-Armenian Conference (on Mathematical Physics, Complex Analysis and related problems, 28 Sep - 3 Oct 2014, Yerevan), Abstracts Book, Yerevan, p. , 09/2014*

**Nikogossian, A. G.** – *Some new directions of astrophysical transfer theory* // *Fifth Russian-Armenian Conference (on Mathematical Physics, Complex Analysis and related problems, 28 Sep - 3 Oct 2014, Yerevan), Abstracts Book, Yerevan, p. 46, 09/2014*

**Pikichyan, H. V.** – *Revealing some "linear structure" of solution in non-linear radiative transfer problem through one-dimensional anisotropic medium* // *Fifth Russian-Armenian Conference (on Mathematical Physics, Complex Analysis and related problems, 28 Sep - 3 Oct 2014, Yerevan), Abstracts Book, Yerevan, p. 48, 09/2014*

**Mickaelian, A. M.** – *Regional Activities related to IAU Strategic Plan and Integration of Armenia in the European Astronomy* // *XVII National Conference of Astronomers of Serbia (NKAS), Abstract Book, Belgrade, Serbia, 09/2014*

**Mickaelian, A. M.; Farmanyan, S. V.** – *Cultures across the sky and the roots of Armenian astronomy* // *XVII National Conference of Astronomers of Serbia (NKAS), Abstract Book, Belgrade, Serbia, 09/2014*

**Harutyunian, H. A.** – *On the Radial Velocities of Dwarf Galaxies – Members of Virgo Cluster* // *Second International Conference on Arabs' and Muslims' History of Science, Abstracts Book, University of Sharjah, p. 41, 12/2014*

**Most productive authors have been** (at least 3 refereed papers or at least 4 publications in total):

Scientists	Refereed journals	Proc. meetings	Electronic catalogs	Books, Theses	Abstracts	Other	All
<b>Abrahamyan, H. V.</b>	3	7					<b>10</b>
<b>Gigoyan, K. S.</b>	2	1	1				<b>4</b>
<b>Hakobyan, A. A.</b>	3	3					<b>6</b>
<b>Harutyunian, H. A.</b>	1	3		1	2		<b>7</b>
<b>Mickaelian, A. M.</b>	1	11		3	4		<b>19</b>
<b>Nazaryan, T. A.</b>	3	3		1			<b>7</b>
<b>Paronyan, G. M.</b>	2	6					<b>8</b>
<b>Petrosian, A. R.</b>	2	3					<b>5</b>
<b>Ter-Kazarian, G. T.</b>	3						<b>3</b>

**Publications by research groups:**

Head of group (number of members)	Refereed journals	Proc. meetings	Electronic catalogs	Books, Theses	Abstracts	Other	All
<b>Harutyunian H.A. (3)</b>	3	3		1	2		<b>9</b>
<b>Khachikian E.Ye. (6)</b>	1	5					<b>6</b>
<b>Magakian T.Yu. (2)</b>	1	1					<b>2</b>
<b>Melikian N.D. (2)</b>	2						<b>2</b>
<b>Mickaelian A.M. (5)</b>	4	14	1	3	4		<b>26</b>
<b>Parsamian E.S. (4)</b>	2	1		1			<b>4</b>
<b>Petrosian A.R. (6)</b>	4	6		1		1	<b>12</b>



## 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 2014, 7 papers were published in AJ, ApJ, A&A, and MNRAS, including 2 in frame of INI (1 A&A and 1 ApJ, 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. Hovhannisyanyan, 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. Sinamyanyan, 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. Since the beginning of 2014, **Prof. Atom Muradyan** is the head of the Chair of General Physics and Astrophysics. E.H. Nikoghossian teaches at Russian-Armenian (Slavonic) University and S.A. Ghazaryan teaches at Artsakh State University. Byurakan scientists have also been supervisors of B.Sc. and M.Sc. Diploma theses at YSU and Russian-Armenian (Slavonic) University.

**Tigran Nazaryan** defended his PhD thesis on 12 May 2014 on the subject *Statistical study of First and Second Byurakan Surveys galaxies and their neighbours* (supervisor: A.R. Petrosian). At present BAO has two Ph.D. students: **Levon Aramyan** (supervisor: A.R. Petrosian) and **Vahagn Harutyunyan** (supervisor: H.A. Harutyunian). In addition, a few other Byurakan fellows are in the stage of preparation of their Ph.D. theses: N.S. Asatryan, A.G. Eghikian, H.V. Abrahamyan and G.M. Paronyan.

**Armenian Astronomical School Olympiad** was held on 5 Apr 2014 in Byurakan (Chair of Jury: A.A. Akopian). The winners were selected for participation in international Olympiads. **8<sup>th</sup> International Olympiad on Astronomy and Astrophysics (IOAA)** was held on 1-10 Aug 2014 in Romania, where Armenian pupils won 2 Silver and 2 Bronze medals (team leaders: Marietta Gyulzadian and Emilia Karapetyan). **19<sup>th</sup> International Astronomical Olympiad (IAO)** was held on 12-21 Oct 2014 in Bishkek and Cholpon-Ata, Kyrgyzstan, where Armenian pupils won 1 Gold medal (team leaders: Marietta Gyulzadian and Avetik Grigoryan).

**First Byurakan Science Camp (1BSC)**. On 19-25 Oct 2014, for the first time, BAO and ArAS organized a Science Camp for school pupils. 25 pupils participated. A.M. Mickaelian, S.V. Farmanyanyan, H.V. Abrahamyan, H.A. Harutyunian, E.S. Parsamian and E.H. Nikoghossian delivered lectures at the Camp.

**ArAS School Lectures**. On 28-31 Oct 2014, 7 astronomers (A.E. Grigoryan, M.V. Gyulzadyan, H.A. Harutyunian, A.M. Mickaelian, E.H. Nikoghossian, H.V. Pikichian, Ar.G. Yeghikian) visited 30 schools in Yerevan and other provinces and gave lectures on *Wonders of the Sky*. The project is supported by ArAS Co-President *Prof. Yervant Terzian* and other American sponsors.

## Membership

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

**European Astronomical Society (EAS, 17 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, N.D. Melikian, A.M. Mickaelian, T.H. Movsessian, E.H. Nikoghossian, 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 Com. 46 “Astronomy Education & Development”:** H.A. Harutyunian (Liaison in Armenia)

**IAU Commission 5 WG on Astronomical Data (WGAD):** A.M. Mickaelian

**IAU Com. 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 Com. 46 WG on Archaeoastronomy and Astronomy in Culture (WGAAC):** A.M. Mickaelian

**Internat. Centre for Relativistic Astrophysics (ICRANet) Board of Directors:** H.A. Harutyunian

**International Virtual Observatory Alliance (IVOA) Executive Committee:** A.M. Mickaelian

**International Planetary Data Alliance (IPDA) Steering Committee:** A.M. Mickaelian

**Large Telescopes Thematic Committee (KTBT):** E.Ye. Khachikian

**Sub-Regional European Astronomical Committee (SREAC):** A.M. Mickaelian

**Galileo Teacher Training Program (GTTP).** A.M. Mickaelian: GTTP Ambassador in Armenia, M.V. Gyulzadyan: GTTP Coordinator in Armenia

## Journal *Astrofizika/Astrophysics*

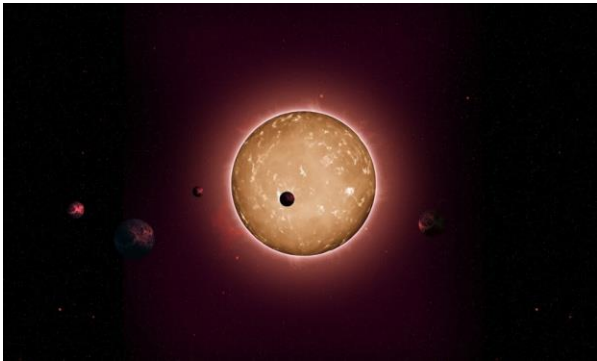
The journal *Astrofizika* (English translation: *Astrophysics*) is being published by the Armenian NAS. Five Byurakan astronomers are involved in the Editorial Board of *Astrofizika* (Editor-in-Chief: Prof. D.M. Sedrakian from the YSU): **A.G. Nikoghossian** (*Deputy Editor-in-Chief*), **A.T. Kalloghlian** (*Secretary-in-Chief*), **H.A. Harutyunian**, **E.Ye. Khachikian**, and **E.S. Parsamian**. Four issues of Vol. 56 were published in Mar, June, Sep and Dec 2014 with 51 papers, including 16 (31.4%) from BAO (compared to 17 out of 48 (35.4%) in 2013, 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, Georgia, China and other countries.

## 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**, ArASNews Editor: **S.V. Farmanyan** (since 2015), Webmaster: **G.A. Mikayelyan**. ArAS has **95 members from 21 countries**, including 56 from Armenia. During 2014, the **ArAS webpage** was updated, eight issues (Nos. 69-76) of the **ArAS Newsletter (ArASNews)** were released, **ArAS XIII meeting** was held on October 7-10 combined with the meeting “*Relation of Astronomy to other Sciences, Culture and Society*”, **ArAS Annual prize for Young Astronomers** was awarded for the 11<sup>th</sup> time (2014 winner: Gurgen Paronyan). During 2014, in frame of the **scientific journalism**, ArAS prepared and circulated 120 press-releases to Armenian mass media with information on sky events, international and local astronomical news that resulted in more than 500 publications.

Areg Mickaelian

## VARDAN ADIBEKYAN in the TEAM DISCOVERING KEPLER 444 FIVE PLANETS



The discovery of five archaic planets around one of the oldest stars in the galaxy has raised the possibility that the Milky Way might be home to extremely ancient forms of life.

Astronomers spotted the planets as they circled a star called Kepler 444, which lies 117 light years from Earth in the direction of Lyra, a constellation in the northern sky.

Researchers used variations in the brightness of the star to calculate its age and found that it was among the first generation of stars to illuminate the Milky Way 11.2bn years ago.

[The sun](#), Earth and other planets of the solar system formed much more recently, about 4.5bn years ago, making the Kepler 444 planetary system more than twice as old as our own. By the time the Earth had formed, the planets around Kepler 444 were already older than the Earth is today.

The planets that orbit Kepler 444 are not hospitable to life as we know it. But the discovery of such profoundly old and almost certainly rocky planets suggests that other ancient worlds might lurk around other stars in more habitable reaches of the Milky Way.

“This tells us that these kinds of planets formed very early in the history of the galaxy. If some fraction formed in the habitable zones around their host stars, then you have environments where life may develop, and it could have been there for a very long time,” said [Bill Chaplin](#), professor of astrophysics at the University of Birmingham.

Writing in [The Astrophysical Journal](#), the scientists add: “Earth-size planets have formed throughout most of the Universe’s 13bn year history, leaving open the possibility for the existence of ancient life in the galaxy.”

The worlds that orbit Kepler 444 are small, at least by planetary standards, and range in size from Mercury to Venus. They are extremely close to their parent star, with all five planets closer in than Mercury is to the sun. A year on each planet lasts fewer than 10 Earth days.

Kepler 444 is about three quarters the size and mass of the sun, and though 700C cooler, the planets circle so close to the star that their surfaces are permanently fried. The habitable zone around the star, where the temperature is just right for liquid water to flow, lies six times further out than the outermost of the five planets, said Chaplin.

Researchers measured the age of the star by using NASA’s Kepler space telescope to observe minute changes in its brightness. The intensity of stars varies because sound waves trapped inside them make them contract and expand, as though they were breathing. When a star compresses it gets hotter and brighter. When it expands, it gets cooler and dimmer.

How a star’s brightness varies depends on the speed of sound waves within, and that is governed by the composition of its core. This material at the heart of the star changes as it grows old, for example, as the star converts its hydrogen fuel into helium.



“As you change the composition of the core, you change the speed at which sound waves moves through the star, and that affects the periods at which it resonates,” said Chaplin. “Because we can do this astroseismology, we can get very precise measurement of the age. It’s a very old star, over a 11bn years old.”

Astronomers are now keen to discover other ancient planetary systems, in the hope of pinpointing the beginning of the era of planetary formation in the universe.

The animation of the Kepler-444 extrasolar system is available in the following link:

[http://www.washingtonpost.com/posttv/national/health-science/what-happens-inside-extrasolar-system-kepler-444/2015/01/27/7b5183dc-a59c-11e4-a162-121d06ca77f1\\_video.html](http://www.washingtonpost.com/posttv/national/health-science/what-happens-inside-extrasolar-system-kepler-444/2015/01/27/7b5183dc-a59c-11e4-a162-121d06ca77f1_video.html)

Vardan Adibekyan

## ASTRONOMICAL CONFERENCE in SHARJAH, UAE



The Second International Conference on Arabs’ and Muslims’ History of Sciences conference was organized jointly with the Arab Union of Astronomy and Space Sciences as part of the scientific and cultural activities that took place in the Emirate of Sharjah in 2014, which was designated as “The City of Sharjah, Cultural Capital of the Muslim World, 2014”.

The Director of Byurakan Astrophysical Observatory (BAO) **Dr. Haik Harutyunian** was the Armenian representative of the conference. He presented a keynote talk on the *Radial Velocities of Dwarf Galaxies – Members of Virgo Cluster*.

The conference program included:

1. **Keynote talks**, which were delivered by renowned speakers specialized in Muslims’ and Arabs’ history of sciences and related topics.
2. **Scientific Research papers**. The papers were refereed by a panel of experts. Accepted papers were scheduled in parallel sessions, where each author was given 20 minutes to orally present their papers including the discussion.
3. **Poster sessions**, which were included, refereed papers that were presented in special poster sessions.
4. **Specialized workshops**, during which special topics will be presented by specialized scholars.
5. **Exhibition** that was displayed material related to topics presented in the conference.
6. **Tourism trips** to various cultural and heritage sites in the City of Sharjah and other UAE cities and culture night.

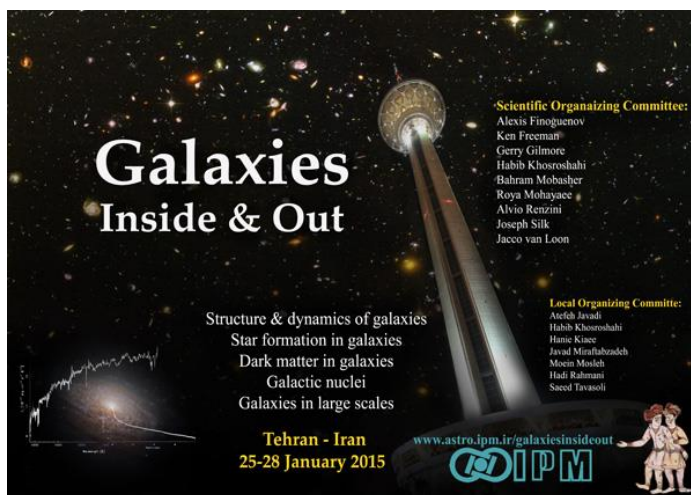
Conference webpage: [www.sharjah.ac.ae](http://www.sharjah.ac.ae)

## WORKSHOP “GALAXIES INSIDE and OUT” in TEHRAN, IRAN

Galaxies Inside and Out workshop took place in Tehran, Iran, from January 25-28. The workshop was held under the organization of Institute for Research in Fundamental Sciences. The aim of the workshop was to discuss the latest developments on the studies of galaxies, including new results and current and upcoming surveys, combined with an overview of the themes covered in the workshop. The themes to be covered in the workshop are:

- Structure and dynamics of galaxies
- Star formation in galaxies
- Dark matter in galaxies
- Active galactic nuclei
- Galaxies in large scales
- Galaxy formation models

The workshop was held at IPM Farmaneyeh building in Tehran. Local attractions include, Nivaran Palace, Sa'dabad Palace and Tajrish Bazar.



### Scientific Organizing Committee:

- Alexis Finoguenov (University of Helsinki)
- Ken Freeman (ANU, Sydney)
- Gerry Gilmore (IoA, Cambridge)
- Habib Khosroshahi (IPM, Tehran)
- Bahram Mobasher (UC, Riverside)
- Roya Mohayaee (IAP, Paris)
- Alvio Renzini (AOP, Padova)
- Joseph Silk (University of Oxford)
- Jacco van Loon (University of Keele)

### Local Organizing Committee:

- Atefeh Javadi
- Habib Khosroshahi
- Hanie Kiaee
- Moein Mosleh
- Hadi Rahmani
- Saeed Tavasoli
- Javad Miraftebzadeh

Leading Scientist and Head of research group of Byurakan Astrophysical Observatory (BAO) **Dr. Areg Mickaelian** was among the **invited speakers** of the workshop.

### Invited speakers

**Areg Mickaelian** (BAO, Armenia), **Alexis Finoguenov** (University of Helsinki), **Alvio Renzini** (AOP, Padova), **Bahram Mobasher** (UC, Riverside), **Feng Yuan** (SHAO, Shanghai), **Fatemeh Tabatabaei** (MPIA, Heidelberg), **Gerry Gilmore** (IoA, Cambridge), **Gary Mamon** (IAP, Paris), **Jesus Falcon** (IAC, Tenerife), **Joseph Silk** (University of Oxford), **Jacco van Loon** (University of Keele), **Marcella Carollo** (ETH, Zurich), **Reynier Peletier** (KIA, Groningen), **Roya Mohayaee** (IAP, Paris), **Sohrab Rahvar** (Sharif Univ, Tehran), **Simon Lilly** (ETH, Zurich) and **Simon Peter Driver** (ICRAR, Perth).

**Workshop Webpage:** <http://www.astro.ipm.ir/conferences/Galaxiesinsideout/>

## YOUNG SCIENTISTS' CONFERENCE in KIEV, UKRAINE



Department of Astronomy & Space Physics and Virtual Roentgen and Gamma Observatory (VIRGO.UA) announce the **22th Open Young Scientists' Conference on Astronomy and Space Physics**. The conference will take place at the Faculty of Physics of the Taras Shevchenko National University of Kiev on April 20-25, 2015.

The conference is intended for participation of students, PhD students and young researchers who are involved in research in one of the following fields:

- atmospheric studies and space geophysics
- Solar physics and heliosphere
- Solar System & extrasolar planets
- stellar astrophysics
- interstellar and intergalactic medium
- extragalactic astrophysics and cosmology
- high-energy astrophysics and astroparticle physics
- positional astronomy and astronomical equipment
- computers in astronomy

During the Conference each young participant should present a short report (12 minutes) about results of his/her research or a poster (with an oral poster presentation for 5 minutes). Besides students' reports several invited lectures are planned.

Working language of YSC'22 is English. The conference programme also includes excursions to the Main Astronomical Observatory of the NAS of Ukraine, Museum of Folk Architecture and Life of Ukraine, Kiev city tour, evening for theatre/opera/organ hall and conference dinner.

In order to participate in the conference it is necessary to submit information about yourself (name, address, institution, affiliation, etc.) along with a short abstract of your report via electronic registration form. The book of abstracts of YSC'22 will be published after the deadline and distributed among the participants during the registration. All the participants are welcome to submit their contributions to peer-reviewed journal *Advances in Astronomy and Space Physics* till **April 30, 2015**.

Conference webpage: <http://ysc.kiev.ua/>

## ASTRONOMERS AMONG NAS RA NEW FOREIGN MEMBERS

On 27th of December, the National Academy of Science of RA (NAS RA) held a general meeting, where three astronomers *Dr. Varoujan Gorjian* (USA), *Dr. Razmick Mirzoyan* (Germany) and *Dr. Armen Sedrakian* (Germany) were elected as foreign members of NAS RA.



**Dr. Varoujan Gorjian** is PhD in Astronomy and Astrophysics and a researcher of NASA's Jet *Propulsion* Laboratory (JPL, USA). He graduated from the California Institute of Technology (Caltech) and University of California, Los Angeles (UCLA). His research is focused on infrared galaxies and active galactic nuclei.



**Dr. Razmick Mirzoyan** is a specialist of High Energy Astrophysics. He is the Head of MAGIC group at Max-Planck-Institute for Physics (MPIP) and MAGIC Telescope Project Manager, leading specialist and speaker of international Taiga cooperation, Professor of Irkutsk State University (ISU, Russia) and the head of the laboratory of ISU Multi-TeV Energy Gamma-Ray Astronomy.



**Prof. Armen Sedrakian** is a specialist of theoretical physics and astronomy. He is a researcher at the Institute for Theoretical Physics at the University of Frankfurt-am-Main. Much of his research is focused on understanding the physics of superfluidity and superconductivity in neutron stars, nuclear matter, quark matter and ultra-cold atoms.

Famous astronomers **Felix Aharonian** (Astrophysics of High Energy, Cosmology, Ireland and Germany), **Georges Alecian** (Astrophysics, France), **Zadig Mouradian** (Solar physics, France), **Vahé Petrosian** (Theoretical Astrophysics, Cosmology, USA) and **Yervant Terzian** (Astronomy, USA) are also NAS RA Foreign members.

We congratulate our colleagues for this election and wish them further fruitful cooperation with Armenian scientists.

## ANSEF GRANT WINNERS 2015



# A.N.S.E.F.

The Armenian National Science & Education Fund

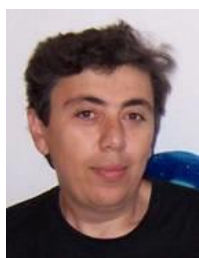


The ANSEF Review Board - with the help of 17 referees - has finished a three month long review of a total of 174 submitted proposals. The Board has identified the 30 proposals with the highest scores as the recipients of the ANSEF 2015 awards. Two of these are the Armenian National Young Scientists Awards. We are happy to list the ANSEF 2015 winners from BAO:



**Levon Aramyan**

The influence of various triggers of star formation on supernova rates



**Tigran Movsisyan**

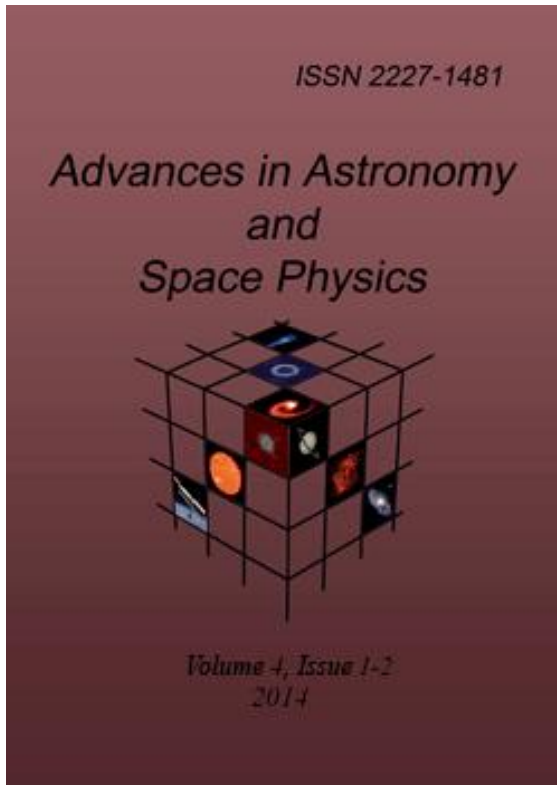
On the nature of various type emission structures in the jets from young stars

Since 2001, in the field of astronomy and astrophysics, ANSEF has supported 40 projects (USD 5000 each; projects by 22 Principal Investigators involving more than 70 scientists), including 34 projects from BAO and 6 from YSU.

**ANSEF Grant Webpage:** <http://www.ansef.org/>



## JOURNAL “ADVANCES in ASTRONOMY and SPACE PHYSICS”



Advances in Astronomy and Space Physics (AASP) represents the new-born "thick" scientific journal. The aim of the journal is to be a broadcast platform for those young scientists who work in astronomy, astrophysics, space physics and related areas: from space geodynamics and astrobiology to cosmology and high-energy astrophysics and in any field one can understand as related to mentioned above. The platform is opened for everybody who is a young scientist and made the essential contribution to the presented article. Created by the joint efforts of Taras Shevchenko National University of Kyiv and the Main Astronomical Observatory of the Ukrainian Academy of Sciences in 2011, the journal is assigned to be a platform for young scientists or teams with young members working in Astronomy, Space Physics or related areas (from geodynamics and astrobiology to cosmology and astroparticle physics).

The issues will be published twice a year, most probably in **February/March** and **October/November**.

Authors should present their manuscripts made only with the AASP LaTeX sample-file and according to the instructions, which can be found on the journal web-page. The maximum size of the paper (in pdf-format) is 5-6 pages. Authors are allowed present another (extended) version of the article to be published electronically under the same title. Those article versions may contain appendices with colour figures, long tables, complicated mathematical treatments, etc. The articles can be accepted for publication only after peer reviews. The review articles by senior scientists (up to 7-8 pages) are also welcome.

**AASP Webpage:** <http://aasp.kiev.ua/>

## ELMA PARSAMYAN in CONVERSATION with BO REIPURTH

### Elma Parsamian

*in conversation with Bo Reipurth*



**Q:** *First of all, congratulations with your 85th birthday! For your thesis you did photometry and polarimetry of cometary nebulae. How did you get interested in young stars, and who was your adviser?*

**A:** My general interest in astronomy began already in early childhood, in primary school. Later I graduated from the Physics and Mathematics Department of Yerevan State University; among the professors were Ambartsumian, Markarian, and Gurzadian (who later became adviser of my PhD thesis), and other well-known Armenian scholars. When I started to work at the Byurakan Observatory in 1954, one of its main areas of study were non-stationary phenomena in stars and galaxies, in particular, the study of T Tauri type stars and related cometary nebulae. At that time Ambartsumian (1947-1949) showed that the process of star formation takes place in the present epoch in young star clusters, which he called stellar associations. At the suggestion of Ambartsumian, I became involved in the studies of cometary nebulae.

**Q:** *In 1965 you published a first catalog of such cometary nebulae. One of these objects, Parsamian 21, has become famous. What is known about this star today?*

**A:** After the appearance of the Palomar Sky Survey, Ambartsumian set the task of finding new cometary nebulae. The catalog mentioned by you was the first result of these studies, and contained only a small portion of the objects discovered. Later, in 1979, they were included in another catalog, compiled by me and my co-worker V. Petrosyan. Among these nebulae are so many interesting objects which have been the subject of study by many astronomers. One of them is the nebulous object Parsamian 21. At a distance of 400 pc, this object (HBC 687) is perhaps best known for its prominent cometary nebula. Although no outburst has been recorded for this object,

Parsamian 21 was identified as a FU Orionis source on the basis of characteristic P Cygni line profiles indicating mass loss and the double absorption lines indicating disk rotation, as identified by Staude & Neckel (1992). They also found that next to the nebula there is a Herbig-Haro object (HH 221). More recently, Tom Greene and collaborators found a great similarity between high-resolution near-infrared spectra of FU Ori and Parsamian 21.

**Q:** *Ambartsumian first proposed that T Tauri stars are young objects. Was he an inspiration and active influence in your work?*

**A:** Ambartsumian's work and ideas inspired many generations of scientists all over the world in different fields of science. Naturally, I was no exception. My direct scientific cooperation with Ambartsumian was in the field of flare stars. It was reflected in a series of four papers "Flare stars in the Pleiades" (Ambartsumian, Mirzoyan, Parsamian et al.), performed in the late 70s of the last century. He was never my direct supervisor, but his ideas, his great scientific authority in the world, his approach to science had a tremendous influence on the formation of my scientific views and interests. Therefore, I consider myself his disciple.

**Q:** *You spent a number of years working in Mexico. How did that come about?*

**A:** In the field of flare stars, Byurakan Observatory collaborated with Tonantzintla Observatory (now INAOE), directed by Guillermo Haro, whose views largely coincided with the views of Ambartsumian on the problem of flare stars. It was at the invitation of Haro, in the framework of cooperation between the two observatories, that I went to Mexico, which I repeatedly visited since 1968.

**Q:** *Guillermo Haro performed the first surveys for H $\alpha$  emission stars in the Orion Nebula Cluster, and later you collected and augmented all these stars into the well known Parsamian-Chavira catalog. How did that project get initiated?*

**A:** A large number of H $\alpha$  emission stars (255), in the region of the Orion Nebula were known as a result of Haro's work in the early 1950's. Subsequent to Haro's original survey, a large number of observations of the Orion Nebula region were carried out by Enrique Chavira with the Tonantzintla Schmidt Telescope (during 27 years), and using photographic plates. My search for H $\alpha$  objects on those plates led to me finding an additional 240 new emission stars. In 1982 together with Chavira I published a catalog of H $\alpha$  stars, adding the newly discovered stars to Haro's previous list.

**Q:** *You have made extensive studies of flare stars in star forming regions. How did you do those observations, and what did you learn?*

**A:** In the 60's and 70's of the last century, the study of flare stars was an important area in astrophysics of stars. It was pursued by scientists from many countries, but the main studies were conducted, in particular, at the Byurakan, Tonantzintla, and Asiago Observatories. I was directly involved in the investigations of flare stars, carried out at these observatories. For my part, I have discovered dozens of flare stars and hundreds of flares, and have also carried out various kinds of statistical analyses. I think that the most important of them is the discovery and study of the relationship (in the form of equations) between the maximum amplitude (energy) of flares and the ages of the stars. This relationship was the basis of the method of determining the age of flare stars and clusters. This method was highly appreciated by Ambartsumian, as an alternative method of determining the age of the clusters. Among other works I can mention the determination of the frequency distribution function of flare stars in the Orion association following the method proposed by Ambartsumian, as well as the work in which a relationship was established between the depth of a flare in the photosphere and the duration of the flare. It was shown that strong flares more frequently take place in the deep layers of the photosphere. All of these results, along with others not mentioned here, came into my second thesis (Doctor of Physics and Mathematical Sciences, 1983).

**Q:** *You have written a number of papers on what was called subfuors, now more commonly known as EXors, especially on V1118 Ori and V1143 Ori. Why are these two stars particularly interesting?*

**A:** In 1982-83, V1143 Ori and V1118 Ori in the Orion association were discovered to have major brightness variations. Previously, such large variability had been studied by Herbig in VY Tau, EX Lup, and some other stars. A characteristic feature of all these objects is a slow increase in brightness sometimes over 100 days or more, a longer period at maximum brightness with small fluctuations, and then a subsequent slow decay. The whole process takes place on a timescale of up to 1.5 years. Ambartsumian coined the term subfuors for these stars, and Herbig called them EXors. My colleague from Spain, Jose Garcia, systematically monitored V1118 Ori for more than two decades, so we have a complete picture of the activity of the star for a long time. The reason that I became interested in these stars was certain similarities of their outbursts with slow flares of flare stars and the outbursts of FUors (albeit on different scales). Our studies have also pointed to an evolutionary relationship between these objects and stars such as T Tauri. When interpreting this phenomenon I assume the hypothesis that Ambartsumian had for the FUors, which in my opinion is undeservedly forgotten. According to Ambartsumian "...An explanation is offered for this phenomenon, based on the assumption

of the presence, prior to the rise in the light curve in the region adjacent to the star, of sources of corpuscular radiation. As indicated by observations, at the time of the rise in brightness, an envelope encompassing those external sources is developed. For that reason, following the rise in brightness, almost all energy from those sources is emitted in the form of thermal radiation flux."

**Q:** *Alongside your astronomical research, you have devoted much effort to archaeoastronomy in Armenia. Which are the main results?*

**A:** The Armenian highland is one of the ancient cradles of civilization. Many early investigators of the history of astronomy concluded that the ancient inhabitants of Armenia not only knew, but also took part in the formation of ancient astronomy (Maunder 1906, Olcott, 1914), but they had very little factual information to build on. The discoveries made during the last decades in Armenia have documented this and enriched our knowledge of the ancient civilization and astronomy in this region. Two regions stand out.

(i) Meزامor

On the bank of the river Meزامor, some 30 km west of Yerevan, a metal-producing centre was found, dating back to the third-fourth millennium BC. One of the most important discoveries was the complex of platforms for astronomical observations on the Small Hill of Meزامor (Parsamian, Mkrтчian 1967-69). It was shown that in the years between 2800-2600 BC, Sirius could have been observed at Solstice in the morning, in the rays of the rising Sun, in the so-called heliacal rising of Sirius. It is possible that, like the ancient Egyptians, the inhabitants of Meزامor related the first appearance of Sirius with the opening of the year.

(ii) Megalithic monument Zoraz Kar (Karahunge)

Among the ancient monuments in Armenia there is a megalithic monument, probably connected with astronomy. 250 km south-east of Yerevan there is a structure, Zoraz Kar (Karahundj), dating back to the II millennium BC. There are vertical megaliths, many of which are more than two meters in height, which form stone rings resembling the ancient stone monuments, called henges, in Great Britain and Brittany (Parsamian 1984-99; Khunkikian 1984; Parsamian, Barsegian 1987; Heruni 1999). In closing, I want to cite Prof. G.S. Hawkins, well-known from his works on Stonehenge. In his letter to Ambartsumian in 1967 he wrote: " I spoke with Elma Parsamian at the I.A.U. Conference in Prague. I think that her work at Meqramor (Meqramor) is very good and she should be encouraged to continue. I am sure that the astronomical alignments at Stonehenge are not unique and would expect to find such astronomical culture in Armenia".

## ANNIVERSARIES: SMBAT BALAYAN – 50



**Dr. Smbat Balayan** was born on January 18, 1965 in Yerevan. In 1990 he graduated from Yerevan State University, Department of Physics with the specialty of Astrophysics, and worked at BAO since 1989. Under the supervision of J. A. Stepanian he participated in the Second Byurakan Survey (SBS) obtaining observational material by carrying out observations with BAO 1m Schmidt telescope. In 1992-1995 he worked as a visiting astronomer at Special Astrophysical Observatory of Russia (SAO). After that he returned to BAO and in 1998 became a fellow of 2.6m telescope laboratory. In 2002 Balayan worked as a visiting astronomer at Hamburg Observatory (Germany). In 2004 he defended his Ph.D. thesis (supervisor: T. Yu. Magakian). In 2006 he was the head of BAO 1m Schmidt

telescope laboratory. His main fields of investigation are astronomical surveys, SBS galaxies and study of astronomical objects, infrared galaxies, X-ray sources, active galactic nuclei and white dwarf stars. As a result Balayan has published more than **30 research papers**, including those in the important international astronomical journals, proceedings of international meetings and several electronic catalogues.

In 2007 he was awarded by Armenian National Science and Educational Fund (ANSEF) a grant for reconstruction of BAO 1m Schmidt telescope. He is ArAS founding member since 1999.

## MONTHLY CALENDAR of ASTRONOMICAL EVENTS: FEBRUARY 2015

Monthly Calendar of Astronomical Events						
February 2015						
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1 Conjunction of Venus vs. Neptune	2	3 Full Moon	4	5	6 Jupiter at opposition	7
8	9	10	11	12 Lunar crescent (last quarter)	13	14
15	16	17 European NEON School	18 New Moon Super Moon	19	20	21 Conjunction of Venus vs. Mars
22 Lunar occultation of Uranus	23	24	25 Lunar crescent (first quarter)	26	27	28 ArAS Newsletter #78 release
NASA's Dawn spacecraft at Ceres						