

# ArAS News

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ARMENIAN ASTRONOMICAL SOCIETY (A r A S)

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The ArAS Newsletter in the INTERNET: <http://www.aras.am/ArasNews/arasnews.html>

## RESULTS of the INTERNATIONAL YEAR of ASTRONOMY



On January 9-10, 2010, the official Closing Meeting of the **International Year of Astronomy (IYA-2009)** took place in Padua, Italy. IYA-2009 was the largest event in the history of astronomy and probably of science in general. A number of projects (called cornerstone and special projects) were conducted and accomplished during 2009, such as 100 Hours of Astronomy, The Galileoscope, Cosmic Diary, The Portal to the Universe, She is an Astronomer, Dark Skies Awareness, Astronomy & World Heritage, Galileo Teacher Training Program, Universe Awareness, From Earth to the Universe, Developing Astronomy Globally, Galilean Nights, StarPeace, etc.

Armenia actively participated in IYA-2009, especially in the projects 100 Hours of Astronomy, The Galileoscope, Cosmic Diary, Astronomy & World Heritage, and Developing Astronomy Globally. We organized a number of meetings and other events all supporting the idea of global development of astronomy in the world and Armenia. Many of these activities are listed and described in the section “Byurakan Astrophysical Observatory in 2009: Annual Report” of this Newsletter. Some of these events (mainly public lectures) were organized out of Byurakan: at the Yerevan State University (YSU), specialized physical-mathematical and other schools in Yerevan. Other activities were related to public advertisement and promotion of astronomy by mass media, etc.

Here we would like to list the following activities in frame of IYA-2009 (meetings, seminars, public lectures, and other events, most of which do not appear in the BAO-2009 annual report):

- |                  |  |
|------------------|--|
| 23 Jan           | Start of the series of biographical articles about outstanding Armenian astronomers at “ <i>Armenpress</i> ” News Agency website. Altogether 20 articles were given during 2009.   |
| 8 Feb            | Opening of the new ArAS webpage with lots of information about Armenian astronomy, as well as IYA-2009. For the first time, research projects, scientific results, publications, meetings, and a large amount of other information about BAO was given.  |
| 28 Feb, Byurakan | Meeting with journalists organized by BAO/ArAS and “ <i>Armenpress</i> ” (Managing Director Hrair Zoryan); 33 journalists from TV, radio, newspapers, and Internet news agencies were present. Presentation of IYA-2009 at international level and in Armenia. Discussion of journalists’ tasks in 2009 and of the problems of scientific journalism in Armenia. |
| 2 Mar, Byurakan  | Celebration of M.A. Arakelian’s 80 <sup>th</sup> and Ye.Terzian’s 70 <sup>th</sup> anniversaries. Two more anniversaries happened in 2009: H.M. Tovmassian’s 80 <sup>th</sup> and E.S. Parsamian’s 80 <sup>th</sup> .  |
| 22 Mar, Byurakan | “ <i>Astrophoto contest</i> ” (Contest of astronomical photos) of the Armenian Institute of Tourism students led by the rector <i>Prof.</i> Robert Minasyan.   |
| 30 Mar, Byurakan | Meeting with representatives of touristic companies (travel agencies). Discussion of problems of scientific tourism in Armenia. The rector of Armenian Institute of Tourism Robert Minasyan, Manager of the Armenian Monuments Awareness Project (AMAP) Rick Ney, and others were present.   |

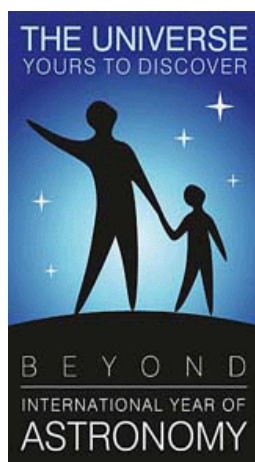
14 Apr, Byurakan	Meeting with foreign Ambassadors and representatives of international organizations. A reception at the 2.6m telescope and presentation of IYA-2009. Discussion of the international collaboration.
15 Apr, Yerevan	IYA-2009 meeting with the students of the Department of Physics of the Yerevan State University (YSU). Report by A.M. Mickaelian " <i>IYA-2009 in the world and in Armenia</i> ". Presentation of the IYA-2009 movie " <i>Eyes on the Skies</i> ".
17 Apr	Establishment of Viktor Ambartsumian International Prize in astrophysics declared by the President of RA Serzh Sargsyan. One of the biggest prizes in astronomy/astrophysics (USD 500,000).
18 Apr, Yerevan	Exhibition " <i>Armenia: a Country of Ancient Astronomy</i> " at the Armenian Union of Architects organized by the Armenian Institute of Tourism.
30 Apr, Byurakan	Meeting between astronomers and architects; 25 architects were present, including the Chair of the Armenian Union of Architects Razmik Minasyan, Director of the Armenian Design Institute Grigor Azizyan, the author of the 2.6m telescope building and other buildings in BAO Sargis Gurzadyan, famous architects Hrachya Poghosyan, Sashur Kalashian, Murad Hasratyan, and others.
4 May, Byurakan	IYA-2009 meeting in Byurakan. Report by A.M. Mickaelian " <i>IYA-2009 in the world and in Armenia</i> ". Discussion of forthcoming events.
15 May, Yerevan	Public lecture at the Department of Physics of the YSU: A.M. Mickaelian " <i>Astronomical telescopes and instrumentation</i> ". Report on " <i>Around the World in 80 Telescopes</i> ".
16 May, Yerevan	Public lecture at the Physical-Mathematical school upper level pupils: A.M. Mickaelian " <i>World astronomical telescopes</i> ".
19 May, Yerevan	Public lecture at Yerevan " <i>Quantum</i> " specialized school upper level pupils: A.M. Mickaelian " <i>World astronomical telescopes</i> " and L.A. Sargsyan " <i>Infrared galaxies</i> ".
26 May, Yerevan	Meeting between astronomers and historians/archaeologists at Matenadaran. Discussion on archaeoastronomy matters and organization of a session on archaeoastronomy during the ArAS VIII annual meeting.
10 June	Production/publication of astronomical promotional materials (calendars, cups, pens, etc.) by " <i>Antares</i> " Holding (President Armen Martirosyan).
19 June, Byurakan	Young artists' exhibition and contest " <i>The Universe and myself</i> " organized jointly by BAO and the Ministry of Culture. Professional artists (the Armenian Union of Artists headed by its Chair Karen Aghamyan) were also invited and together with astronomers were included in the jury of the pictures contest.
6-8 July, Byurakan	ArAS VIII annual meeting " <i>Astronomy and Society</i> " with invitation of historians/archaeologists, biologists, geologists, etc. For the first time, problems of archaeoastronomy and astrobiology were included in the topics. Astronomical education, international collaboration, and other matters were also discussed.
18 Sep	The official Day of Astronomy in Armenia. Public observations by amateur astronomers in Yerevan.
25 Sep, Yerevan	Public lectures by French-Armenian astronomers at the YSU Department of Physics: Alain Sarkissian " <i>Study of Earth's and planetary atmospheres</i> " and Georges Alecian " <i>Study of Chemically Peculiar Stars and Asteroseismology</i> ".
1 Oct, Yerevan	Public lecture at Yerevan secondary school #64 upper level pupils: A.M. Mickaelian " <i>World astronomical telescopes</i> ".

- 8-16 Nov International Astronomy Olympiad (IAO) in Hangzhou, China. Armenian pupils Hayk Hakobyan and Hayk Tepanyan won First-rank Diploma.
- 15 Dec, Yerevan Opening of Viktor Ambartsumian's monument in Yerevan.
- 28 Dec, Yerevan Armenian IYA-2009 Closing Ceremony at the Armenian National Academy of Sciences (NAS RA). Report on IYA-2009 by A.M. Mickaelian. Awards to astronomers and journalists.

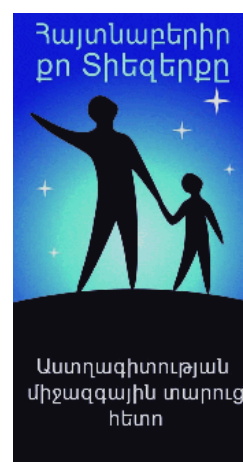
The IYA-2009 webpage is available at <http://www.astronomy2009.org/> and the IYA-2009 Armenian webpage, at [http://www.aras.am/IYA\\_2009.htm](http://www.aras.am/IYA_2009.htm).

*Areg Mickaelian,  
IYA-2009 Armenian Coordinator*

## BEYOND IYA-2009



The International Year of Astronomy (IYA-2009) was the largest science education and public outreach event in history. Many of IYA-2009 activities and projects that were started in 2009 will go on, as the legacy of IYA-2009. IYA-2009 was in fact an important start of a new era in development and popularization of astronomy throughout the world. The IAU has suggested to call the continuing IYA-2009 projects “**Beyond IYA-2009**” as a whole. This concerns the year 2010 and beyond depending on the activities. Especially important were and will continue the IYA-2009 cornerstone projects



Portal to the Universe (PTTU), Astronomy and World Heritage, Galileo Teacher Training Program (GTTP), Universe Awareness (UNAWA), Developing Astronomy Globally (DAG), etc.

In addition, during its XXVII General Assembly in Rio de Janeiro, the IAU has accepted a “**Decadal Strategic Plan**” for 2010-2020 where the development of astronomy worldwide is recognized as a the IAU global program. In frame of this project, IAU will create regional offices (Offices for Astronomy Development, OAD) in each of the defined eight regions. In frame of the GTTP project, Armenia will participate in the training of Galileo teachers. These are teachers who receive training in the effective use and transfer of astronomy education tools and resources into classroom science curricula and disseminate this knowledge among their peers.

## BYURAKAN ASTROPHYSICAL OBSERVATORY in 2009: ANNUAL REPORT

### Introduction



Since the foundation in 1946 the Byurakan Astrophysical Observatory (BAO) and up to the beginning of 1990s BAO was publishing an annual almanac called “*Communications of the Byurakan Astrophysical Observatory*”. Sometimes, especially before the establishing of the journal “*Astrofizika*” it might have more than one issue yearly. “*Communications*” did not have sharply defined scientific priorities and therefore accepted for publication papers of very wide spectrum, including articles on the results of the astronomical instruments’ designing and meteorological data for perspective

astronomical sites. In 1990s it became extinct imperceptibly. At the beginning everybody was convinced that publishing was interrupted temporarily and the almanac would recommence its life very soon. Unfortunately it did not happen not in 1990s nor in the new millennium. BAO as a part of the whole country passed through many difficulties and the recommence of the “*Communications*” appeared not to be among the first priorities. However, with the suspension of the “*Communications*” the observatory has lost one of the very important aspects of its institutional privileges. The point is that the “*Communications*” have been traditionally publishing some kind of a brief report on the BAO activity and also have served as a keeper of the observatory’s chronology. Now every person can find a lot of interesting facts and data concerning the activity of the BAO for more than three decades. After that the chronology is incomplete and sparse.

During the last decades new means of communications have been created which do not demand any big financial expenditure. The electronic publications are now available and this possibility should be used to prepare and publish a number of documents for which the shortage of money always was the main insuperable obstacle. Therefore, after a rather long time we intend to renew the publications of the Annual Reports of the BAO at least.

During the last five-six years many scientific-organizational events have been held at the BAO or with an active participation of BAO. Undoubtedly an essential change underwent the relations between Yerevan State University (YSU) and the BAO. Before that BAO was suffering continuously from the lack of young astronomers. First of all the summer practice of students of the YSU Chair of Astrophysics at BAO have been re-established in since 2004. Moreover, every second year summer schools are being organized at the BAO for the students of the YSU Department of Physics. Owing to this renewed policy in relations between two organizations has appreciably increased the number of students interested in becoming an astrophysicist. Some students were hired for work at BAO while engaged in their Master courses. And at present there are about a dozen young astronomers recruited during last two years.

Obviously, the scientific events held at BAO in the course of recent years added the attractiveness of astrophysics in students’ eyes as well. Besides the summer schools arranged for the YSU students in local formats international schools for young astrophysicists are being organized every second year since 2006 at BAO. Armenian young scientists and students get an exceptional chance for attending lectures and training of recognized specialist from foreign scientific centers and also make the acquaintance of their peers from abroad. The same happens during the conferences held at the BAO.

Last year was not an exception though no any big event on the international level has been organized. However the fact that the year 2009 was declared an International Year of Astronomy (IYA-2009) actually had an effective impact in the life of the observatory. Though not on an international level, but many meetings and other events have been arranged at BAO in the course of the whole year. These events were rather important both for organization of scientific activity in the observatory, for discussion of the prospects of international collaboration and also for the public relations.

All the mentioned events are briefly reflected in this report. We would like to mention about very happy tidings in the introduction since it has played and certainly will play an important role in the future development of mutually useful relations with the international organizations. In 2009, for the first time were paid all the debts of Armenia to the IAU accumulated for seven years duties. For paying the debts about ten thousand Swiss Francs was gathered thanks to a drive initiated by Mr.

Chahe Tanachian from Canada. The rest of money amounting about twelve thousand Swiss Francs was paid by the Armenian National Academy of Sciences (NAS) subject to be reimbursed by the Armenian State Committee for Science (SCS).

An updated for financial and other issues Annual Report will very soon appear at BAO webpage at <http://www.bao.am>.

### Structure of BAO and research staff

At present formally 68.5 positions are financially backed by the Armenian Government for BAO. The corresponding financial assets are obtained from the budget through two channels, called Basic Program and Thematic groups. 52 positions are included into Basic Program “*Evolution of Cosmic Objects via their Activity*”. The greater part of researchers (25 persons), as well as all the technical and administrative services are maintained owing to this program. Also 5 thematic groups altogether consisted of 16.5 positions for researchers are financed separately. At the expense of mentioned positions BAO supports its staff of 80 persons.

There are three persons in the administration; Director (Haik Harutyunian), Deputy Director (Norair Melikian), and Scientific Secretary (Elena Nikogossian). In the November 2009 the term of office of BAO Director Haik Harutyunian was extended for two more years by the Presidium of NAS RA according to the Academy Statutes. The scientific groups of “*The Study of Long Period Variables and Binaries*” headed by Norair Melikian and “*The Armenian Virtual Observatory*” headed by Areg Mickaelian are integrated into the Basic Program’s scientific subdivision. Three laboratories of scientific-technical character, namely, the laboratories of the 2.6m telescope, 1m Schmidt telescope, and smaller telescopes service are parts of Basic Program. Scientifically heads of the mentioned laboratories, Tigran Movsessian (2.6m), Smbat Balayan (1m), and Artur Amirkhanian (Small Telescopes) had been attached to thematic groups. Balayan and Amirkhanian were relieved of their positions in the group headed by E.Ye. Khachikian and moved completely into the Scientific Subdivision of the Basic Program.

Four young astrophysicists have been recruited in 2009 and ten staff members retired and three of them resigned for some reason or other.

### Research at BAO

As before (in fact since its foundation) 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, Virtual Observatories (VOs). To describe the main results obtained during 2009, the abstracts of published papers are given.

### **Stars and Nebulae**

#### **Progress in spectral studies of the FBS blue stellar objects**

Sinamyanyan, P.K.; Mickaelian, A.M. (*Ap* 52, 76, 2009)

Spectral observations of 10 FBS blue stellar objects (BSO) with the OHP 1.93-m and BAO 2.6-m telescopes have been carried out, and overall progress in all the spectral observations and classifications of FBS BSO over 1987–2000 and in the classification of these objects based on all the accessible sources – in all, 753 out of 1103 objects – is discussed. Representative slit spectra for the major types of objects are presented and compared with digitized low dispersion

spectra from the DFBS. The nature of the FBS objects is examined in terms of advances in the spectral studies. Two-color diagrams are constructed from the SDSS data and are used to find the regions occupied by the various types for further identification of objects of unknown type.

### **FBS 2213+421, an extremely red object with C-rich characteristics**

Gigoyan, K.S.; Russeil, D.; Sarkissian, A.; Sargsyan, L.A. (*Ap* 52, 451, 2009)

One of the most interesting FBS late-type stars, an extremely red object M5-M6 FBS 2213+421 was studied. Two spectra were obtained on 17.11.2008 with BAO 2.6m telescope equipped with ByuFOSC spectrograph. Absorption bands of the C<sub>2</sub> molecule at  $\lambda$ 5165,  $\lambda$ 5636, and  $\lambda$ 6192, CN at  $\lambda$ 7100, SiC<sub>2</sub> at  $\lambda$ 4871 and  $\lambda$ 4982 were found proving the carbon-rich nature of the object. But the most intense lines are NaI D (and H $\alpha$ ) indicating the latest N-subclass of this object. NIR colours and variability were also investigated. It shows an unusual light curve of long-period Mira-type variables with a period of P~630 days estimated from color-index K-[12]. Using the revised Period-Luminosity relations for Galactic carbon Miras, bolometric absolute magnitude was estimated as -5.23<sup>m</sup> and absolute magnitude in 2MASS K band as -8.80<sup>m</sup>. The distance from the Sun was estimated as R=7.2kpc and the distance from the Galactic plane, Z=1.47kpc. The total mass-loss rate was estimated as  $\sim 10^{-5} M_{\odot}/\text{yr}$ .

### **Star formation and molecular clouds**

Gyulbudaghian, A.L. (*Ap* 52, 168, 2009)

The hypothesis advanced by V. A. Ambartsumian according to which stars are formed from protostellar superdense objects – protostars – was an alternative to the hypothesis of the 1950's (and even now, not much changed) according to which stars are formed by accretion with subsequent collapse (in various modifications). Ambartsumian's basic inferences were based on an analysis of the observational data available at that time. This paper presents both Ambartsumian's pioneering ideas and some modern hypotheses of star formation. Some results from studies of molecular clouds and star formation regions are also discussed. One of the distinctive features of young stellar objects (YSO) is the outflow of matter from these objects (molecular, in the form of jets, etc.), a phenomenon whose importance for the evolution of stars was noted by Ambartsumian as long ago as 1937. Radial systems of dark globules are examined, as well as H-H objects associated with star formation regions, cometary nebulae, and close Trapezium type systems (consisting of YSO).

### **Search for HH-objects and emission stars in star formation regions. VI. Herbig-Haro objects and emission stars in the region of the GM 1-64 and GM 2-4 nebulae**

Nikogossian, E.H.; Magakian, T.Yu.; Movsessian, T.A.; Khanzadyan, T. (*Ap* 52, 501, 2009)

Three new Herbig-Haro and 12 emission stars, mainly belonging to the T Tau class, have been discovered in a study of the region of the GM 1-64 and GM 2-4 nebulae in the direction of the galactic anticenter. GM 1-64 and GM 2-4 are typical cometary nebulae illuminated by emission stars. In GM 2-4 the central star is surrounded by a dense dust envelope and is observed only in the IR. Two stellar-like sources which are bright in the IR are found in this same region and can be regarded as young, Class 1 stars. One of them (CPM 19) is surrounded by a compact group of fainter PMS objects. It is found that CPM 19 shows up clearly in the optical range and undergoes large amplitude brightness variations.

### **Herbig-Haro flows in 3D: the HH 83 jet**

Movsessian, T.A.; Magakian, T.Yu.; Moiseev, A.V.; Smith, M.D. (*A&A* 508, 773, 2009)

The kinematics of the HH 83 optical outflow, located in the L 1641 molecular cloud, are investigated. Observations were carried out with the Fabry-Perot scanning interferometer on the 6-m telescope of the Special Astrophysical Observatory. The H $\alpha$  emission line was scanned with a spectral resolution of R = 8200. The radial velocity along the jet increases with distance from the source, confirming previous results. It also shows lower amplitude variations which are not correlated with intensity. Both the spatial width of the jet as well as the FWHM of the H $\alpha$  emission line in the jet tend to decrease with distance from the source. The velocity field across the jet demonstrates a decrease from the center to the edges as well as some evidence for a transverse velocity gradient. The blue-shifted bow shock is separated spatially and spectrally into two distinct features, divided by about 2 arcsec and 250 km s<sup>-1</sup>, accordingly. Evidence is provided that these split features correspond to forward and reverse shocks caused by a rapid pressure increase as the jet begins a new oblique impact on the surrounding medium. Radial velocity variations lengthwise and transverse to the jet axis are discussed. Linear extrapolation of the jet velocity up to the location of the terminal shock region yields the radial velocity of the reverse jet shock. The data are consistent with an abrupt outburst about one thousand years ago which ejected material with total speeds of up to 400 km s<sup>-1</sup>.

### **Near-IR Spectroscopy of Young Stars in the Braid Nebula Star Formation Region in Cygnus OB7**

Aspin, C.; Beck, T.L.; Pyo, T.-S.; Davis, C.J.; Schieven, G.M.; Khanzadyan, T.; Magakian, T.Yu.; Movsessian, T.A.; Nikogossian, E.G.; Mitchison, S.; Smith, M.D. (*AJ* 137, 431, 2009)

We present 1.4-2.5  $\mu$ m integral field spectroscopy of 16 stars in the Braid Nebula star formation region in Cygnus OB7. These data form one aspect of a large-scale multiwavelength survey aimed at determining an unbiased estimate of the number, mass distribution, and evolutionary state of the young stars within this 1 deg<sup>2</sup> area of the previously poorly studied Lynds 1003 molecular cloud. Our new spectroscopic data, when combined with Two Micron All Sky Survey near-IR photometry, provide evidence of membership of many of these objects in the regions' pre-main-sequence population. We discuss both the characteristics of the young stars found in the region and the level of star-forming activity present.

### **Spitzer 24 $\mu\text{m}$ Excesses for Bright Galactic Stars in Boötes and First Look Survey Fields**

Hovhannisyian, L.R.; Mickaelian, A.M.; Weedman, D.W.; et al. (*AJ* 138, 251, 2009)

Optically bright Galactic stars ( $V \leq 13^m$ ) having  $f_{\nu}(24\mu\text{m}) > 1 \text{ mJy}$  are identified in Spitzer mid-infrared surveys within  $8.2 \text{ deg}^2$  for the Boötes field of the NOAO Deep Wide-Field Survey and within  $5.5 \text{ deg}^2$  for the First Look Survey (FLS). One hundred and twenty-eight stars are identified in Boötes and 140 in the FLS, and their photometry is given.  $(K - [24])$  colors are determined using K magnitudes from the Two Micron All Sky Survey for all stars in order to search for excess  $24 \mu\text{m}$  luminosity compared to that arising from the stellar photosphere. Of the combined sample of 268 stars, 141 are of spectral types F, G, or K, and 17 of these 141 stars have  $24 \mu\text{m}$  excesses with  $(K - [24]) > 0.2^m$ . Using limits on absolute magnitude derived from proper motions, at least eight of the FGK stars with excesses are main-sequence stars, and estimates derived from the distribution of apparent magnitudes indicate that all 17 are main-sequence stars. These estimates lead to the conclusion that between 9% and 17% of the main-sequence FGK field stars in these samples have  $24 \mu\text{m}$  infrared excesses. This result is statistically similar to the fraction of stars with debris disks found among previous Spitzer targeted observations of much brighter, main-sequence field stars.

### **A pre-outburst spectrum of KT Eri from the Digitized First Byurakan Survey (DFBS)**

Nesci, R.; Mickaelian, A.; Rossi, C. (*ATel* #2338, 2009)

A historical spectrum, taken on Jan 25 1971, of the recently exploded Nova KT Eri is recorded on the plate n. 0350 of the First Byurakan Survey (FBS). This Survey was made with a thin objective prism atop the 102/130/213 cm Schmidt telescope of the Byurakan Observatory and IlaF emulsion, covering the wavelength range 3400-6900 Å. Nearly all the plates of this Survey (a.k.a Markarian Survey) have been digitized by a collaboration of the Byurakan Observatory, University La Sapienza, Rome Italy, and Cornell University (USA).

### **Stellar associations**

Kalloghlian, A.T. (*Ap* 52, 157, 2009)

This article is intended to remind us of the history of the origins of one of the fundamental discoveries of the twentieth century, stellar associations, which are connected with the name of V. A. Ambartsumian. It is not a complete discussion of all the published work, for this is, of course, impossible. Research on stellar associations began immediately after their discovery and continues to this day. Observations are now also carried out by automatic satellites and a vast amount of observational data has been obtained. Many stellar associations have been discovered, both in our galaxy and in other galaxies. Catalogs of stellar associations have been compiled and many problems relating to stellar associations have been solved.

### **Irradiation of dust in molecular clouds. I. UV doses**

Yeghikyan, A.G. (*Ap* 52, 288, 2009)

The radiation fluxes inside molecular clouds owing to a neighboring class A star or to isotropic interstellar irradiation are calculated. Radiation within the interval  $912 \text{ \AA} < \lambda < 2067 \text{ \AA}$  is found to penetrate deeply enough to ensure a radiation dose for water ice on the order of 100 eV/amu or more over the lifetime of the clouds, whether a star formation region is present or not. The possibility is discussed of using these results for an astrophysical interpretation of published data from laboratory experiments on irradiation of ices of the type  $\text{H}_2\text{O}:\text{CH}_3\text{OH}:\text{NH}_3:\text{CO}$ . The resulting radiation-chemical transformation of complex organic materials may play an important role in the prebiological evolution of the dust component of molecular clouds.

## ***Extragalactic Astronomy***

### **Five supernova survey galaxies in the southern hemisphere. I. Optical and near-infrared database**

Hakobyan, A. A.; Petrosian, A. R.; Mamon, G. A.; et al. (*Ap* 52, 40, 2009)

The determination of the supernova (SN) rate is based not only on the number of detected events, but also on the properties of the parent galaxy population. This is the first paper of a series aimed at obtaining new, refined, SN rates from a set of five SN surveys, by making use of a joint analysis of near-infrared (NIR) data. We describe the properties of the 3838 galaxies that were monitored for SNe events, including newly determined morphologies and their DENIS and POSS-II/UKST I, 2MASS and DENIS J and Ks and 2MASS H magnitudes. We have compared 2MASS, DENIS and POSS-II/UKST IJK magnitudes in order to find possible systematic photometric shifts in the measurements. The DENIS and POSS-II/UKST I band magnitudes show large discrepancies (mean absolute difference of  $0.4^m$ ), mostly due to different spectral responses of the two instruments, with an important contribution ( $0.33^m$  rms) from the large uncertainties in the photometric calibration of the POSS-II and UKST photographic plates. In the other wavebands, the limiting near infrared magnitude, morphology and inclination of the galaxies are the most influential factors which affect the determination of photometry of the galaxies. Nevertheless, no significant systematic differences have been found between any pair of NIR magnitude measurements, except for a few percent of galaxies showing large discrepancies. This allows us to combine DENIS and 2MASS data for the J and Ks filters.

### **The radial distribution of core-collapse supernovae in spiral host galaxies**

Hakobyan, A.A.; Mamon, G.A.; Petrosian, A.R.; Kunth, D.; Turatto, M. (*A&A* 508, 1259, 2009)

With the goal of providing constraints on the nature of the progenitors of core-collapse (CC) supernovae (SNe), we compare their radial distribution within their spiral host galaxies with the distributions of stars and ionized gas in spiral disks. SNe positions are taken from the Asiago catalog for a well-defined sample of 224 SNe within 204 host galaxies. The SN radial distances are estimated from the deprojected separations from the host galaxy nuclei, and normalized

both to the 25th mag-arcsec<sup>-2</sup> blue-band isophotal radius and (for the first time) to the statistically-estimated disk scale length. The normalized radial distribution of all CCSNe is consistent with an exponential law, as previously found, with a possible depletion of CCSNe within one-fifth of the isophotal radius (less significant with scale-length normalization). There are no signs of truncation of the exponential distribution of CCSNe out to 7 disk scale lengths. The scale length of the distribution of type II SNe appears to be significantly larger than that of the stellar disks of their host galaxies, but consistent with the scale lengths of Freeman disks. SNe Ib/c have a significantly smaller scale length than SNe II, with little difference between types Ib and Ic. The radial distribution of type Ib/c SNe is more centrally concentrated than that of the stars in a Freeman disk, but is similar to the stellar disk distribution that we infer for the host galaxies. All CCSN subsamples are consistent with the still uncertain distribution of H II regions. The scale length of the CCSN radial distribution shows no significant correlation with the host galaxy morphological type, or the presence of bars. However, low luminosity as well as inclined hosts have a less concentrated distribution (with the scale-length normalized radial distances) of CCSNe, which are probably a consequence of metallicity and selection effects, respectively. The exponential distribution of CCSNe shows a scale length consistent with that of the ionized gas confirming the generally accepted hypothesis that the progenitors of these SNe are young massive stars. Given the lack of correlation of the normalized radial distances of CCSNe with the morphological type of the host galaxy, we conclude that the more concentrated distribution of SNe Ib/c relative to SNe II must arise from the higher metallicity of their progenitors or possibly from a shallower initial mass function in the inner regions of spirals.

### Star Formation Rates for Starburst Galaxies from Ultraviolet, Infrared, and Radio Luminosities

Sargsyan, L.A.; Weedman, D.W. (*ApJ* 701, 1398, 2009)

We present a comparison of star formation rates (SFR) determined from mid-infrared 7.7  $\mu\text{m}$  polycyclic aromatic hydrocarbon (PAH) luminosity [SFR(PAH)], from 1.4 GHz radio luminosity [SFR(radio)], and from far-ultraviolet luminosity [SFR(UV)] for a sample of 287 starburst galaxies with  $z < 0.5$  having Spitzer IRS observations. The previously adopted relation  $\log [\text{SFR(PAH)}] = \log [vL_{\nu}(7.7 \mu\text{m})] - 42.57 \pm 0.2$ , for SFR in  $M_{\odot}/\text{yr}^{-1}$  and  $vL_{\nu}(7.7 \mu\text{m})$  the luminosity at the peak of the 7.7  $\mu\text{m}$  PAH feature in  $\text{erg s}^{-1}$ , is found to agree with SFR(radio). Comparing with SFR(UV) determined independently from ultraviolet observations of the same sources with the Galaxy Evolution Explorer mission (not corrected for dust extinction), the median  $\log [\text{SFR(PAH)/SFR(UV)}] = 1.67$ , indicating that only 2% of the ultraviolet continuum typically escapes extinction by dust within a starburst. This ratio SFR(PAH)/SFR(UV) depends on infrared luminosity, with the form  $\log [\text{SFR(PAH)/SFR(UV)}] = (0.53 \pm 0.05) \log [vL_{\nu}(7.7 \mu\text{m})] - 21.5 \pm 0.18$ , indicating that more luminous starbursts are also dustier. Using our adopted relation between  $vL_{\nu}(7.7 \mu\text{m})$  and  $L_{\text{ir}}$ , this becomes  $\log [\text{SFR(PAH)/SFR(UV)}] = (0.53 \pm 0.05) \log L_{\text{ir}} - 4.11 \pm 0.18$ , for  $L_{\text{ir}}$  in  $L_{\odot}$ . Only blue compact dwarf galaxies show comparable or greater SFR(UV) compared to SFR(PAH). We also find that the ratio SFR(PAH)/SFR(UV) is similar to that in infrared-selected starbursts for a sample of Markarian starburst galaxies originally selected using optical classification, which implies that there is no significant selection effect in SFR(PAH)/SFR(UV) using starburst galaxies discovered by Spitzer. These results indicate that SFRs determined with ultraviolet luminosities require dust corrections by a factor of  $\sim 10$  for typical local starbursts but this factor increases to  $>700$  for the most luminous starbursts at  $z \sim 2.5$ . Application of this factor explains why the most luminous starbursts discovered by Spitzer at  $z \sim 2.5$  are optically faint; with this amount of extinction, the optical magnitude of a starburst having  $f_{\nu}(7.7 \mu\text{m})$  of 1 mJy should be  $V \sim 25.6$ .

### The Lyman Alpha Morphology of Local Starburst Galaxies: Release of Calibrated Images

Östlin, G.; Hayes, M.; Kunth, D.; Mas-Hesse, J.M.; Leitherer, C.; Petrosian, A.; Atek, H. (*AJ* 138, 923, 2009)

We present reduced and calibrated high resolution Lyman-alpha ( $\text{Ly}\alpha$ ) images for a sample of six local star-forming galaxies. Targets were selected to represent a range in luminosity and metallicity and to include both known  $\text{Ly}\alpha$  emitters and nonemitters. Far ultraviolet imaging was carried out with the Solar Blind Channel of the Advanced Camera for Surveys on the Hubble Space Telescope (HST) in the F122M ( $\text{Ly}\alpha$  online) and F140LP (continuum) filters. The resulting  $\text{Ly}\alpha$  images are the product of careful modeling of both the stellar and nebular continua, facilitated by supporting HST imaging at  $\lambda \approx 2200, 3300, 4400, 5500, \text{H}\alpha$ , and 8000 Å, combined with Starburst 99 evolutionary synthesis models, and prescriptions for dust extinction on the continuum. In all, the resulting morphologies in  $\text{Ly}\alpha$ ,  $\text{H}\alpha$ , and UV continuum are qualitatively very different and we show that the bulk of  $\text{Ly}\alpha$  emerges in a diffuse component resulting from resonant scattering events.  $\text{Ly}\alpha$  escape fractions, computed from integrated  $\text{H}\alpha$  luminosities and recombination theory, are found never to exceed 14%. Internal dust extinction is estimated in each pixel and used to correct  $\text{Ly}\alpha$  fluxes. However, the extinction corrections are far too small (by factors from 2.6 to infinity) to reconcile the emerging global  $\text{Ly}\alpha$  luminosities with standard recombination predictions. Surprisingly, when comparing the global equivalent widths of  $\text{Ly}\alpha$  and  $\text{H}\alpha$ , the two quantities appear to be anticorrelated, which may be due to the evolution of mechanical feedback from the starburst. This calls for caution in the interpretation of  $\text{Ly}\alpha$  observations in terms of star formation rates. The images presented have a physical resolution 3 orders of magnitude better than attainable at high redshifts from the ground with current instrumentation and our images may therefore serve as useful templates for comparing with observations and modeling of primeval galaxy formation. We therefore provide the reduced  $\text{Ly}\alpha$ ,  $\text{H}\alpha$ , and continuum images to the community.

### Local Lyman $\alpha$ emitters and their relevance to high-redshift star-forming galaxies

Mas-Hesse, J.M.; Kunth, D.; Atek, H.; Östlin, G.; Leitherer, C.; Petrosian, A.; Schaerer, D. (*ApSS* 320, 35, 2009)

The  $\text{Ly}\alpha$  line is an important diagnostic of star formation and activity in galaxies. The analysis of  $\text{Ly}\alpha$  is complicated due to the resonant nature of the line and radiative transfer effects. High spectral resolution studies of local starburst galaxies with the unprecedented UV capabilities of the HST have shown that this line is either seen in absorption or in emission and in the latter case with a P Cygni profile indicative of a large scale outflow of neutral gas. Moreover, HST imaging

obtained with HST-ACS of a sample of 6 star-forming galaxies has revealed that a substantial fraction of the Ly $\alpha$  photons are diffused far away from the emissive knots. Since the importance of Ly $\alpha$  for tracing large scale structure, correlation functions, and galaxy formation is recognized, Ly $\alpha$  will remain a very important probe of the distant universe for the foreseeable future, and it is therefore imperative to acquire a better understanding of what mechanisms regulate our ability to detect this line.

### **The morphological and spectral investigation of the galaxies Kaz 5, Kaz 92, and Kaz 390**

Adibekyan, V.Zh.; Kazarian, M.A.; Karapetian E.L. (*Ap* 52, 54, 2009)

The results of morphological and spectral study of the galaxies Kaz 5, Kaz 92, and Kaz 390 are presented. The observations were made on the 2.6-m telescope at the Byurakan Observatory with the VAGR microlenses spectrograph. Isophotes of the images of the galaxies are constructed in the H $\alpha$ , [NII]  $\lambda\lambda$ 6584, 6548, and [SII]  $\lambda\lambda$ 6731, 6717 emission lines and in the continuum. The masses of Kaz 5 and Kaz 92 are determined to be  $8.6 \times 10^8 M_{\odot}$  and  $6.1 \times 10^9 M_{\odot}$ , respectively. The mass of the gaseous component in the centers of regions I and IV of Kaz 390, which encompass a 1 pixel area, are also determined. The morphological structure of the central region of Kaz 5 in the observed spectral range,  $\lambda\lambda$ 6400–6800 $\text{\AA}$ , differs completely from the structure of the same part of the galaxy observed with the 6-m and 2.5-m telescopes. It is shown that these differences in the structure in images of Kaz 5 are mostly explained by the comparatively low resolution of the telescope in combination with the VAGR spectrograph. Absorbing matter also contributes to this effect. It is also shown that a “deficit” of nitrogen has been observed in the region of Kaz 390 studied here (a circle of diameter 40”).

### **Study of the dependence of the star formation rate in the nuclear regions of 39 Kazarian galaxies on their integral parameters**

Adibekyan, V.Zh.; Petrosian, A.R. (*Ap* 52, 192, 2009)

A statistical study of the dependence of the star formation rate in the nuclear regions of 39 Kazarian galaxies on the integral parameters of these galaxies is carried out on the basis of spectra from SDSS DR6. The value of SFR/kpc $^2$  for our sample lies in the range  $0.013 \div 2.04 M_{\odot} \text{ year}^{-1} \text{ kpc}^{-2}$  (with the maximum value of 2.04 corresponding to the Kaz 98 (merger)). It is found that the surface density of the rate of star formation correlates positively with the bar structure parameter and  $EW(H\alpha)$ , and that, for spiral galaxies of early morphological types, SFR/kpc $^2$  is greater than for the later types. It is shown that the color  $B-R$  for the galaxies and the color  $(U-g)_{nuc}$  for the nuclear region correlate positively with the total absorption  $A(H\alpha)$  in the H $\alpha$  line for the nuclear region. The average value of  $A(H\alpha)$  for our samples is found to be  $A(H\alpha) = 1.3 \pm 0.09$  magnitudes.

### **Optical classification of 18 infrared galaxies**

Sargsyan, L.A. (*Ap* 52, 377, 2009)

Optical classifications are provided for 18 infrared objects whose spectra have been obtained with the Spitzer space telescope. An attempt is made at classification in terms of the spectral energy distributions (SED) based on photometric data from the SDSS and 2MASS (11 objects, 4 of which also have SDSS spectra) archives. 7 of the objects are classified using the SDSS spectra, and other sources are used for 5 of the objects, 4 of which cannot even be classified using spectral or photometric data. For 3 of the objects, the classifications according to photometric data and the SDSS spectra are the same, so it is to be hoped that the proposed classification can be used for classifying many objects when only photometric data are available. These objects have also been classified according to their IR spectra. The IR and optical classifications are mostly in agreement when they are compared. Morphological descriptions of the objects are also given.

### **GPS and CSS radio sources**

Malumian, V.H. (*Ap* 52, 494, 2009)

The spectral and kinematic properties of GPS and CSS radio sources and methods for determining their ages are discussed. The data presented here do not support a mechanism of accretion of dust or molecular gas on massive black holes located in the central regions of radio galaxies of these classes as the source of their activity. The nature of GPS and CSS objects has not been fully clarified. Further detailed studies in the optical, radio, and other spectral ranges will be required in order to establish the true nature of this class of source.

### **Relationship of galaxies from the second Byurakan survey to Zwicky clusters. II. Discussion**

Gyulzadian, M.V.; Petrosian, A.R.; McLean, B. (*Ap* 52, 205, 2009)

We analyze the data presented in a previous paper by Gyulzadian and Petrosian, and discuss the results of a statistical investigation of the relationship between SBS galaxies and Zwicky clusters. The main results are that SBS galaxies follow the overall galaxy distribution in clusters and they do not avoid any type of Zwicky cluster. There is a significantly higher probability of finding SBS galaxies occurring in medium compact clusters than in open clusters. They also follow the well-established morphology-density relation. Earlier morphological type, higher luminosity, larger linear size, and redder SBS galaxies tend to be found in clusters with higher compactness, or in more compact regions of the clusters. The number distribution of SBS galaxies in Zwicky open clusters probably follows the distribution of normal galaxies. The number distribution of SBS galaxies in medium compact and compact clusters shows two-maxima structure.

## **Clustering of galaxies on scales of $\leq 10 h^{-1}$ based on the Coma, Bridge, and A1367 clusters**

Kogoshvili, N.G.; Borchkhadze, T.M.; Kalloghlian, A.T. (*Ap* 52, 482, 2009)

A correlation analysis is made of the spatial distribution of galaxies in the Coma, Bridge, and A1367 clusters, which form the Coma supercluster. The scale of the clustering of galaxies and the variation in their density distribution with the main parameters of the galaxies – luminosity, morphological type, and observed H I deficiency in the 21 cm line – are evaluated. The mass-to-luminosity ratios are computed for the spiral galaxies in the Coma, Bridge, and A1367 clusters. It is suggested that a larger fraction of hypothetical dark matter may be concentrated in the spiral galaxies which predominantly populate the subclusters previously identified by us within these clusters than in the spiral galaxies observed in the peripheral regions of the clusters.

## **Optical properties of Markarian galaxies**

Petrosian, A.; McLean, B.; Allen, R.J.; MacKenty, J.W. (*VizieR Catalog: J/ApJS/170/33*, 2009)

Images extracted from the STScI Digitized Sky Survey (DSS) of Fpg(red) and Jpg(blue) band photographic sky survey plates obtained by the Palomar and UK Schmidt telescopes.

## **NGP+30° zone galaxies. I.**

Petrosian, A.; McLean, B.; Allen, R.; Kunth, D.; Leitherer, C. (*VizieR Catalog: J/ApJS/175/86*, 2009)

We took the galaxies from a CfA2 strip (see Huchra et al., 1990, Cat.)  $8h \leq RA \leq 17h$  and  $26.5^\circ \leq \delta \leq 32.5^\circ$ , and cross-checked this sample with all known possible sources of active or star-forming galaxies. The optical measurements of these galaxies are based on the digitized F- and J-band images extracted from the photographic plates obtained for the second Palomar Observatory Sky Survey (POSS-II; Reid et al., 1991PASP, 103, 661R).

## **A catalog of Kazarian galaxies**

Kazarian, M.A.; Adibekyan, V.Zh.; McLean, B.; Allen, R.J.; Petrosian, A.R. (*VizieR Catalog: VII/254*, 2009)

The entire Kazarian galaxies (KG) catalog is presented which combines extensive new measurements of their optical parameters with a literature and database search. The measurements were made using images extracted from the STScI Digitized Sky Survey (DSS) of Jpg(blue), Fpg(red) and Ipg(NIR) band photographic sky survey plates obtained by the Palomar and UK Schmidt telescopes. We provide accurate coordinates, morphological type, spectral and activity classes, blue apparent diameters, axial ratios, position angles, red, blue and NIR apparent magnitudes, as well as counts of neighboring objects in a circle of radius 50 kpc from centers of KG. Special attention was paid to the individual descriptions of the galaxies in the original Kazarian lists, which clarified many cases of misidentifications of the objects, particularly among interacting systems. The total number of individual Kazarian objects in the database is now 706. We also include the redshifts which are now available for 404 galaxies and the 2MASS infrared magnitudes for 598 KG. The database also includes extensive notes, which summarize information about the membership of KG in different systems of galaxies, and about revised activity classes and redshifts. An atlas of several interesting subclasses of KG is also presented. Images extracted from the STScI Digitized Sky Survey (DSS) of Fpg(red) Jpg(blue), and Ipg(NIR) band photographic sky survey plates obtained by the Palomar and UK Schmidt telescopes.

## **Surveys and Databases**

### **Byurakan spectral sky surveys. Blue stellar objects in the strip at $\delta = +47^\circ$**

Erastova, L.K. (*Ap* 52, 369, 2009)

This is a list of 111 blue stellar objects and individual active galaxies with excess ultraviolet continuum lying within  $08^h - 17^h$  in  $\alpha$  and  $+45^\circ - +49^\circ$  in  $\delta$  (1950.0). The surveyed objects are classified in terms of activity type.

### **The DFBS Spectroscopic Database and the Armenian Virtual Observatory**

Mickaelian, A.M.; Sargsyan, L.A.; Atsatryan, H.V.; Cirimele, G.; Nesci, R. (*Data Sci. J.* 8, 152, 2009)

The Digitized First Byurakan Survey (DFBS) is the digitized version of the famous Markarian Survey. It is the largest low-dispersion spectroscopic survey of the sky, covering 17,000 square degrees at galactic latitudes  $|b| > 15$ . DFBS provides images and extracted spectra for all objects present in the FBS plates. Programs were developed to compute astrometric solution, extract spectra, and apply wavelength and photometric calibration for objects. A DFBS database and catalog has been assembled containing data for nearly 20,000,000 objects. A classification scheme for the DFBS spectra is being developed. The Armenian Virtual Observatory is based on the DFBS database and other large-area surveys and catalogue data.

### **The Digitized First Byurakan Survey on ArmCluster**

Mickaelian, A.M.; Atsatryan, H.V.; Sahakyan, V.G.; et al. (*Proc. CSIT-2009 conf.* 7, 420, 2009)

The Digitized First Byurakan Survey (DFBS) is the digitized version of the famous Markarian Survey, also known as the First Byurakan Survey (FBS). It is the largest low dispersion spectroscopic survey of the sky covering 17,000 square degrees at galactic latitudes  $|b| > 15^\circ$ . DFBS provides the astronomical community with images and extracted spectra for all objects present in the FBS plates. Some 1800 plates have been scanned and stored and programs were developed to compute the astrometric solution, extract the spectra, and apply wavelength and photometric calibration for the objects. The DFBS database and catalog have been assembled containing data for nearly 20,000,000 objects. A classification scheme for the DFBS spectra is being developed. DFBS has been installed on dedicated servers at Universita di Roma "La Sapienza" (Italy) and at present on the ArmCluster at the Institute for Informatics and Automation Problems (Armenia). A work is active on making the DFBS available through the Virtual Observatory standards and access to

spectroscopic data. From the point of view of VO, the DFBS is a new database needing both image and spectra access tools and an interchange between these two standards. Algorithms, tools, and facilities needed for efficient use of the DFBS are discussed, in particular the spectra extraction, visualization, and analysis tools. New scientific projects as well as existing surveys will benefit by the digitized images and the ready-to-use extracted spectra which will allow an efficient computer-based analysis of the dataset. The Armenian Virtual Observatory (ArVO) is based on the DFBS database and other large-area surveys and catalogue data and is a part of the International Virtual Observatory Alliance (IVOA).

### **Development of Armenian-Georgian Virtual Observatory**

Mickaelian, A.; Kochiashvili, N.; Astsatryan, H.; et al. (*Proc. CSIT-2009 conf. 7, 424, 2009*)

The Armenian-Georgian Virtual Observatory (ArGVO) project is the first initiative in the world to create a regional VO infrastructure based on national VO projects and regional Grid. The Byurakan and Abastumani Astrophysical Observatories are scientific partners since 1946, after establishment of the Byurakan observatory. The Armenian VO project (ArVO) is being developed since 2005 and is a part of the International Virtual Observatory Alliance (IVOA). It is based on the Digitized First Byurakan Survey (DFBS, the digitized version of famous Markarian survey) and other Armenian archival data. Similarly, the Georgian VO will be created to serve as a research environment to utilize the digitized Georgian plate archives. Therefore, one of the main goals for creation of the regional VO is the digitization of large amounts of plates preserved at the plate stacks of these two observatories. The total amount of plates is more than 100,000 units. Observational programs of high importance have been selected and some 3000 plates will be digitized during the next two years; the priority is being defined by the usefulness of the material for future science projects, like search for new objects, optical identifications of radio, IR, and X-ray sources, study of variability and proper motions, etc. Having the digitized material in VO standards, a VO database through the regional Grid infrastructure will be active. This partnership is being carried out in the framework of the ISTC project A-1606 "Development of Armenian-Georgian Grid Infrastructure and Applications in the Fields of High Energy Physics, Astrophysics and Quantum Physics".

### **Recovery of asteroids in the Digitized First Byurakan Survey**

Berthier, J.; Sarkissian, A.; Mickaelian, A.; Thuillot, W. (*EPSC 4, 526, 2009*)

The project aims at discovery and study of the low-dispersion spectra of the known solar system objects, mainly asteroids, in the DFBS fields. With a limiting V magnitude close to 18 for the fainter sources in the FBS, we roughly estimate to a few hundreds the number of spectra of asteroids that can be detectable in the DFBS. The spectral characterization of asteroids is important for understanding the evolution of their compositional and mineralogical properties. This knowledge is also important to study and quantify the physical properties of the interior of asteroids (e.g. composition, structure, bulk density). Nowadays, the number of asteroids for which spectra have been acquired is about few thousands. Most of them have been recorded in the past 20 years during dedicated surveys. Even if these surveys have already measured most of the brighter asteroids which may be detectable in the DFBS, it remains useful to discover spectra in the DFBS in order to carry on the building up of the collections of spectra of asteroids in the visible wavelength. It could also offer a unique opportunity to study the time-dependent modification of the surface reflectivity of asteroids by comparing the FBS spectra (acquired between 1965 and 1980) and recent ones (post 1990). The actual number of asteroids which are detectable in the DFBS depends on their magnitude and apparent velocity at the epoch of observation combined with the exposure time of the plates ranging from 15 to 90 minutes. For a given exposure time, the spectrum of a given asteroid is spread over the plate in the direction of its motion proportionally to its apparent velocity. The extraction of asteroid spectra in the DFBS plates requires to solve two main issues: the identification of the targets in the plates and the calibration of their spectra. The localization and the identification of the solar system objects in the field of views are performed using the SkyBoT web-service. This VO tool makes easy to know which asteroids are located in any field of view at any epoch. Then, by looking among the known asteroids located in each plate, we are able to cross match them with the sources taking into account the known stars. We have developed a dedicated workflow in the VO framework to extract and analyze the DFBS spectra. The analysis of the DFBS has led to the recovery of 216 asteroids up to magnitude 16. The full analysis of the asteroid spectra must now be performed by means of the classical methods used to analyze planetary spectra. That will provide physical characterizations of the objects, such as the surface spectral reflectance in the visible and, therefore, an estimation of the composition of the surface of the recovered asteroids.

## **Theoretical Astrophysics**

### **Ambartsumian's methods in the theory of radiative transfer**

Nikoghossian, A.G. (*Ap 52, 1, 2009*)

The purpose of this article is to provide some insight into Ambartsumian's methods in the theory of radiative transfer, their applications, and further development. Two of these methods are emphasized--the invariance principle and the method of addition of layers, proposed by Ambartsumian in the 1940's. The difference between these methods and the classical approach for solving radiative transfer problems is discussed. We discuss only a small portion of the subsequent work by others that we believe reveals, in a more intuitive way, the essence and significance of Ambartsumian's methods and their efficiency for applications. Thus, for example, a separate section is devoted to applications of the Lagrangian formalism to radiative transfer and it is shown that the invariance principle is a special case of a more general variational principle that reflects an invariance with respect to translational transformation of the optical depth. Our discussion of the method of addition of layers points out its generality and the major role it has played in the later creation of such methods as Bellman's invariant imbedding method and the method for solving radiative transfer problems in inhomogeneous media. The latter method has yielded a number of new analytic results. The concluding section is a brief summary of Ambartsumian's results in the nonlinear theory of radiative transfer, where he was a pioneer in the study of the class of multilevel problems. This article also sets out to demonstrate the place and role

of Ambartsumian's methods in the theory of radiative transfer, which, to a great extent, set the path along which this theory developed for many years to come.

### **Ambartsumian's invariance principle and some nonlinear relations in radiative transfer theory**

Nikoghossian, A.G. (*Ap* 52, 431, 2009)

This paper is devoted to one of the methods proposed by Ambartsumian in radiative transfer theory – the invariance principle. The possible connection of several well known nonlinear relations in the theory to a variational principle involving a translational transformation of the optical depth is discussed.

### **Ambartsumian's paradigm for the activity of galactic nuclei and the evolution of galaxies**

Harutyunian, H.A. (*Ap* 52, 307, 2009)

Ambartsumian's paradigm for the creation of galaxies owing to the decay of denser matter is examined. The roots of this concept can be found in the very earliest papers of Ambartsumian on quantum fields and the structure of atomic nuclei. In the early 1930's his papers contained new ideas regarding the ejection by one physical object of another which had not originally existed inside the first. The basic observational data which served as the basis for the final formulation of the new concept are described. Special attention is devoted to those objects and phenomena, which, upon further study, have confirmed the validity of Ambartsumian's reasoning and arguments. It is noted that the discovery of Hubble expansion's acceleration of the universe opened up new possibilities for the interpretation of activity phenomena in terms of Ambartsumian's concept. The further extension of this concept is discussed and it is suggested that the major result of this approach should be the proof of the existence of galaxies of all ages within a finite volume of space.

## **Meetings held in Byurakan**

### **Meeting with journalists, 28 Feb 2009**

Presentation of the International Year of Astronomy (IYA-2009) at international level and in Armenia. Discussion of journalists' tasks in 2009 and of the problems of scientific journalism in Armenia. 33 journalists from TV, radio, newspapers, and Internet news agencies were present.

### **Arakelian-80 and Terzian-70 anniversaries meeting, 2 Mar 2009**

Celebration of Marat Arakelian's 80<sup>th</sup> and Yervant Terzian's 70<sup>th</sup> anniversaries. Reports on life and activity of M.A. Arakelian and Ye. Terzian presented by A.M. Mickaelian. Other talks and reports.

### **Meeting with representatives of touristic companies, 30 Mar 2009**

Discussion of problems of scientific tourism in Armenia.

### **Meeting with Ambassadors and representatives of international organizations, 14 Apr 2009**

A reception at the 2.6m telescope and presentation of IYA-2009. Discussion of the international collaboration.

### **Armenian Astronomical School Olympiad, 26 Apr 2009**

The final stage of the annual astronomical contest for school pupils and selection of candidates for the International Astronomical Olympiad.

### **Meeting between astronomers and architects, 30 Apr 2009**

Meeting with architects and an excursion in Byurakan. 25 architects were present.

### **Young artists' exhibition with invitation of professional artists, 19 June 2009**

Young artists' exhibition and contest "*The Universe and myself*" organized jointly by BAO and the Ministry of Culture of RA. Professional artists (the Armenian Union of Artists headed by its Chair Karen Aghamyan) were also invited and together with astronomers were included in the jury of the pictures contest.

### **Third Byurakan Summer School for YSU students, 1-8 July 2009**

Summer school for the lower level B.Sc. students from the Department of Physics of the YSU for an acquaintance with BAO and to help them in selection of the future profession. 31 students were present.

### **Summer Practice for students of the YSU Department of Physics, 1-17 July 2009**

Traditional summer practice for the 3<sup>rd</sup> year students of the YSU Department of Physics. During July 1-8 they simultaneously took part in the Third Byurakan Summer School for YSU students and ArAS VIII Annual Meeting.

### **ArAS VIII meeting “Astronomy and Society”, 6-8 July 2009**

ArAS VIII annual meeting “Astronomy and Society” with invitation of historians/archaeologists, biologists, geologists, etc. For the first time, problems of archaeoastronomy and astrobiology were included in the topics. Astronomical education, international collaboration, and other matters were also discussed.

### **French-Armenian Workshop, 22-23 Sep 2009**

The second French-Armenian astronomical workshop. Reports of joint research and discussion of the future collaboration. Three French scientists participated (Daniel Kunth, Georges Alecian, and Alain Sarkissian).

### **Workshop “Grid Infrastructures in the South Caucasus Region”, 30 Sep 2009**

A workshop in frame of the CSIT-2009 (Computer Science and Information Technologies) conference “Grid Infrastructures in the South Caucasus Region: Present Status and Perspectives”, mainly devoted to the reports and discussion of the ISTC A-1451 and A-1606 projects.

## **Telescopes and observations**

As during the previous years, only the 2.6m telescope worked for scientific projects. The 1m Schmidt telescope is still not working, however a large reconstruction project has been conducted sponsored by the *Vivacell* company. Students from the Third Byurakan Summer School undertook an interesting project to set up remote control for the 1m Schmidt and succeeded to manage its movements from a Laptop computer.

Byurakan astronomers use a few other international telescopes for their collaborative projects, such as the Russian Special Astrophysical Observatory (SAO) 6m telescope (T.Yu. Magakian’s team), Italian Asiago 1.8m and Loiano 1.5m telescopes (A.M. Mickaelian’s team), and others.

A detailed report with the lists of 2.6m observations and fulfilled projects, as well as on the reconstruction project of the 1m Schmidt telescope and the state of smaller telescopes at BAO will appear soon at BAO webpage.

## **Plate Archive, Library, and Internet resources**

BAO Plate archive is at present situated at the first floor of the old laboratory building. A new Head was appointed in 2009: Parandzem Sinamyan. A work on creation of electronic journals for all Byurakan observations has been started. At present 27,000 exposures have already been archived. An electronic BAO Plate Database (BPD) is being created, which will serve as a reference tool for further usage of these observational material in frame of the Armenian Virtual Observatory (ArVO). Similar work has been started at BAO library to create an electronic reference database of the existing literature. During 2009, a significant improvement was made to increase the speed of BAO Internet by establishing a new connection within the Armenian research Educational Networking Association (ARENA).

## **Collaboration**

The year 2009 was the last one for the **French-Armenian collaboration PICS 2007-2009** (coordinators: Georges Alecian and Arthur Nikoghossian). Eight visits by Armenian astronomers to France were accomplished by R.R. Andreyan, K.S. Gigoyan, A.A. Hakobyan, A.M. Mickaelian, T.H. Movsessian, A.G. Nikoghossian (twice), and A.R. Petrosian (see section “Academic Visits”). Several French institutions were involved. The second French-Armenian Workshop was held in Byurakan on Sep 22-23.

Other collaborations are active with:

- Department of Astronomy, Cornell University, Ithaca, USA (A.M. Mickaelian, L.A. Sargsyan)
- Space Telescope Science Institute (STScI), Baltimore, USA (A.R. Petrosian, A.A. Hakobyan, M.V. Gyulzadian)
- Armagh Observatory, UK (T.Yu. Magakian, T.H. Movsessian, E.H. Nikoghossian)

- Hamburger Sternwarte (HS), Germany (A.M. Mickaelian, K.S. Gigoyan, L.A. Sargsyan)
- University of Bonn, Germany (A.G. Yeghikian)
- Physics Department, Sapienza Universita di Roma, Italy (A.M. Mickaelian, K.S. Gigoyan, L.A. Sargsyan, P.K. Sinamyan)
- Astronomical Observatory of Catania, Italy (A.R. Petrosian, A.A. Hakobyan)
- University of Santiago de Compostela, Spain (N.D. Melikian, A.A. Karapetian)
- Special Astrophysical Observatory (SAO), Russia (T.Yu. Magakian, T.H. Movsessian, E.H. Nikogossian)
- Georgian National (Abastumani) Astronomical Observatory (GENAO), Georgia (A.M. Mickaelian et al.)
- Yerevan State University (YSU), Armenia (A.R. Petrosian, V.Zh. Adibekyan)
- Institute of Informatics and Automation Problems (IIAP), NAS RA, Armenia (A.M. Mickaelian, L.A. Sargsyan, et al.)

## Research grants

International research grants support the research at BAO and are a significant contribution compared to the low level of national funding. In 2009, following projects were active:

**CRDF ARP1-2849-YE-06** (2007-2010): *“Digitized First Byurakan Survey and Armenian Virtual Observatory”*, Armenian Co-PI: A.M. Mickaelian, USA Co-PI: Daniel Weedman

**INTAS** (2007-2009): *“”*, PI: H.A. Harutyunian

**ISTC A-1451** (2007-2009): *“Development of Scientific Computing Grid on the Base of Armcluster for South Caucasian Region”*, Leading Institution: Institute of Informatics and Automation Problems (IIAP) of NAS RA, BAO sub-manager: A.M. Mickaelian

**ISTC A-1606** (2008-2010): *“Development of Armenian-Georgian Grid Infrastructure and applications in the Fields of High Energy Physics, Astrophysics and Quantum Physics”*, Leading Institution: Institute of Informatics and Automation Problems (IIAP) of NAS RA, BAO sub-manager: A.M. Mickaelian

**ANSEF** (2009): *“Integral Field Spectroscopy of Different Types Radio Galaxies with Various Linear Sizes”*, PI: G.A. Ohanian

**CNRS-SCS** (are approved for 2010-2011): *“Abundance stratifications and stellar pulsations”*, PIs: Haik Harutyunian and Georges Alecian; *“Search and monitoring of young stellar objects”*, PIs: Tigran Magakian and Jerome Bouvier; *“Different type of SNe, stellar populations, and star-formation in galaxies”*, PIs: Artashes Petrosian and Daniel Kunth

## Academic Visits

Altogether, 11 Byurakan scientists had 17 academic visits to astronomical centres of 6 countries (USA, France, Germany, Italy, Spain, and Russia). As before, most active collaboration was with French institutions (altogether 8 visits of 7 scientists). Three times Armenian scientists visited USA and Germany (each).

**L.A. Sargsyan**, Department of Astronomy, Cornell University, Ithaca, NY, USA, Jan-Mar 2009, 2 months (SST IRS)

**A.G. Nikoghossian**, Observatoire de Paris-Meudon (OBSPM), France, Jan 2009, 2 weeks (PICS)

**A.G. Yeghikian**, University of Bonn, Germany, Feb-May 2009, 3 months

**E.Ye. Khachikian**, Caltech, USA, Feb-May 2009, 3 months

**A.R. Petrosian**, Astronomical Observatory of Catania, Italy, Mar-Apr 2009, 1 month

**T.H. Movsessian**, Special Astrophysical Observatory (SAO), Russia, May 2009, 1 week

**A.M. Mickaelian**, LATMOS, France, July-Aug 2009, 2 weeks (PICS/Europlanet)

**A.G. Nikoghossian**, Observatoire de Paris-Meudon (OBSPM), France, Aug 2009, 2 weeks (PICS)

**T.H. Movsessian**, Observatoire de Grenoble, France, Sep-Oct 2009, 2 weeks (PICS)

**A.M. Mickaelian**, Hamburger Sternwarte (HS), Germany, Oct-Dec 2009, 2 months (DAAD)

**L.A. Sargsyan**, Hamburger Sternwarte (HS), Germany, Oct-Dec 2009, 2 months (DFG)

**A.R. Petrosian**, Institute d’Astrophysique de Paris (IAP), France, Oct-Nov 2009, 1 month

**A.R. Petrosian**, Space Telescope Science Institute (STScI), USA, Nov 2009 – Mar 2010, 4 months  
**A.A. Hakobyan**, Institute d'Astrophysique de Paris (IAP), France, Nov 2009, 4 weeks (PICS/OV-France)  
**R.R. Andreasyan**, Observatoire de Paris-Meudon, France, Nov-Dec 2009, 3 weeks (PICS)  
**K.S. Gigoyan**, Observatoire de Marseille-Provence (OAMP), France, Dec 2009, 3 weeks (PICS/Europlanet)  
**N.D. Melikian**, Universidad Santiago de Compostela, Spain, Dec 2009, 2 weeks

### Visits of foreign scientists

Nine foreign scientists visited Byurakan during 2009, one of them (Daniel Kunth) twice. As for foreign missions of our scientists, again most active was the collaboration with France (three visitors: Daniel Kunth, Georges Alecian, and Alain Sarkissian).

**Daniel Kunth**, Institute d'Astrophysique de Paris (IAP), France, May 2009, 1 week  
**Daniel Weedman**, Cornell University, Ithaca, NY, USA, 5-22 Aug 2009, 3 weeks  
**Georges Alecian**, Observatoire Paris-Meudon (OBSPM), France, Sep 2009, 1 week  
**Daniel Kunth**, Institute d'Astrophysique de Paris (IAP), France, Sep 2009, 1 week  
**Alain Sarkissian**, LATMOS, France, Sep 2009, 1 week  
**Vladimir Hagen-Thorn**, St. Petersburg State University (SPbSU), Russia, Sep 2009, 1 week  
**Nino Kochiashvili**, Georgian National Astronomical Observatory (GENAO), Georgia, 28 Sep – 4 Oct 2009, 1 week  
**Rezo Natsvlishvili**, Georgian National Astronomical Observatory (GENAO), Georgia, 28 Sep – 4 Oct 2009, 1 week  
**Massimo Turatto**, Catania Astrophysical Observatory, Italy, Oct 2009, 1 week  
**Giovanni Strazzulla**, Catania Astrophysical Observatory, Italy, Oct 2009, 1 week

### Participation in Meetings

During 2009, Byurakan astronomers have participated in 13 meetings, including the IAU XXVII General Assembly in Brazil, JENAM-2009 in UK, as well as other meetings in Japan, France, Germany (2), Spain, Georgia, the International Astronomical Olympiad in China, and 3 meetings and a summer school in Byurakan.

**Arakelian-80 and Terzian-70 Anniversaries Meeting**, 2 Mar 2009, Byurakan, Armenia (BAO staff).

**Joint European and National Astronomical Meeting 2009 (JENAM-2009)**, 20-23 Apr 2009, University of Hertfordshire, Hatfield, UK (A.M. Mickaelian)

**Euro-VO AIDA workshop “How to Publish Data in the VO”**, 22-26 June 2009, European Space Astronomy Centre (ESAC), Villafranca del Castillo, Madrid, Spain (S.A. Ghazaryan)

**Third Byurakan Summer School for YSU students**, 1-8 July 2009, Byurakan, Armenia (H.A. Harutyunian, T.Yu. Magakian, A.M. Mickaelian, L.A. Sargsyan)

**ArAS VIII Annual Meeting**, 6-8 July 2009, Byurakan, Armenia (BAO staff)

**Daniel Chalonge 13th Paris Cosmology Symposium “The Standard Model of the Universe: From Inflation to Today Dark Energy”**, 23-25 July 2009, Observatoire de Paris, France (A.M. Mickaelian)

**IAU XXVII General Assembly**, IAU Symposium # 267, SpS2, and SpS5, 3-14 Aug 2009, Rio de Janeiro, Brazil (A.M. Mickaelian)

**French-Armenian Astronomical Workshop**, 22-23 Sep 2009, Byurakan, Armenia (BAO staff)

**Workshop on Grid technologies in frame of CSIT-2009**, 30 Sep 2009, Byurakan, Armenia (H.A. Harutyunian, T.Yu. Magakian, A.M. Mickaelian, L.A. Sargsyan, P.K. Sinamyan)

**Astrophysical Data Analysis Software and Systems (ADASS-XIX)**, 4-8 Oct 2009, Sapporo, Japan (A.M. Mickaelian)

**International conference dedicated to 100th anniversary of M. Vashakidze "Radiation of cosmic objects: from radio to gamma astronomy"**, 7-11 Oct, 2009, Abastumani, Georgia (A.A. Hakobyan, A.G. Nikoghossian, E.H. Nikogossian)

**IVOA Interoperability meeting and IVOA Executive Committee meetings**, 8-12 Nov 2009, European Southern Observatory (ESO), Garching, Germany (A.M. Mickaelian)

**14<sup>th</sup> International Astronomical Olympiad (IAO)**, 8-16 Nov 2009, Hangzhou, China (M.V. Gyluzadian, A.A. Hakopian)

**Workshop "Plate Archive Digitization and Preservation"**, 20-21 Nov 2009, Astrophysikalische Institut Potsdam (AIP), Germany (A.M. Mickaelian)

### Talks and posters presented at meetings

During 2009, Byurakan astronomers presented 41 oral and 7 poster contributions in 9 meetings (in UK, Brazil, Japan, Georgia, Germany, and 4 in Byurakan) and gave 6 lectures at the Third Byurakan Summer School for YSU students.

**Arakelian-80 and Terzian-70 Anniversaries Meeting** (2 oral contributions, other short reports)  
A.M. Mickaelian: "*Marat Arakelian's life and scientific activity*"; "*Yervant Terzian's life and scientific activity*"

**JENAM-2009** (1 oral contribution and 2 posters)

EAS Symposium "*The IYA-2009 in Europe*":

A.M. Mickaelian: "*IYA-2009 activities in Armenia*" (oral)

SpS "*The local volume: constraints on galaxy formation and evolution*":

A.M. Mickaelian: "*Byurakan-IRAS Galaxy pairs as indicators of starburst and galaxy evolution*" (poster)

SpS "*The Virtual Observatory and distributed computing*":

A.M. Mickaelian: "*Using VO tools for multiwavelength studies of Markarian galaxies*" (poster)

**Third Byurakan Summer School for YSU students** (6 lectures)

H.A. Harutyunian: "*Ambartsumian and the Byurakan Observatory*"

T.Yu. Magakian: "*Computers in Astronomy*"

A.M. Mickaelian: "*Modern Astronomy*" (Introductory lecture); "*Achievements of the Byurakan Observatory and current projects*"; "*Astronomical instrumentation*"

L.A. Sargsyan: "*Astronomical data reduction and analysis software*"

**ArAS VIII Annual Meeting** (19 oral contributions)

V.Zh. Adibekyan: "*Dependence of star formation rate on integral parameters of galaxies in circumnuclear regions of 39 Kazarian galaxies*"

G.A. Broutian: "*Development of the Armenian calendar since ancient times to Middle Ages*"

K.S. Gigoyan: "*Investigations of late-type stars at high galactic latitudes*"

M.V. Gyluzadian: "*Astronomical teaching in the Armenian astronomical Olympic groups (2005-2009)*"

A.A. Hakobyan: "*Radial distribution of core-collapse Supernovae in spiral host galaxies*"

H.A. Harutyunian: "*An attempt of interpretation of the observed abundance of chemical elements in frame of the Byurakanian cosmological concept*"; "*Astronomical Education in Armenia*"; "*Byurakan Observatory as regional scientific-educational centre*"

A.A. Karapetian: "*Study of irregular variable stars and nebulae in Cyg OB7*"

T.Yu. Magakian: "*Search and study of compact star formation regions*"

A.M. Mickaelian: "*Ten-year Activities of ArAS (1999-2009)*"; "*Role of the international collaboration in the development of world science/astronomy*"

- T.H. Movsessian: "The nature of the jet of HL Tau"  
 E.H. Nikoghossian: "PMS objects in the region of Cyg OB7"  
 L.A. Sargsyan: "Star formation rate of starburst galaxies obtained from UV, IR, and radio luminosities";  
 "Spitzer Space Telescope and the origin of life"  
 P.K. Sinamyan: "Study of the FBS blue stellar objects"  
 A.G. Yeghikian: "Astrobiology: many-side study of the problems concerning the origin, evolution, expansion,  
 and disappearance of life, as well as its detection in the Universe"; "Does Mars atmosphere methane  
 originate from viruses?"

#### **IAU XXVII General Assembly (3 posters)**

- IAU GA SpS #2 "The International Year of Astronomy 2009"  
 A.M. Mickaelian: "IYA-2009 activities in Armenia"  
 IAU Symposium # 267 "Evolution of Galaxies and Central Black Holes: Feeding and Feedback"  
 A.M. Mickaelian: "Byurakan-IRAS Galaxy pairs as indicators of starburst and galaxy evolution"  
 IAU GA SpS #5 "Accelerating the Rate of Astronomical Discovery"  
 A.M. Mickaelian: "Using large surveys, multiwavelength catalogs, and databases for new discoveries"

#### **French-Armenian Astronomical Workshop (14 oral contributions and 1 poster)**

- R.R. Andreasian: "The Optical and Radio Properties of Extragalactic Radio Sources. Single-dish and Radio-  
 interferometric Study of their Neutral Hydrogen Content" (oral)  
 K.S. Gigoyan: "Search and Study of Extremely Red Objects in the DFBS Database" (oral)  
 A.A. Hakobyan: "Different Type of Supernovae. Stellar Population and Star Formation in Galaxies" (oral)  
 H.A. Harutyunian: "BAO and the General Scientific Politics in Armenia" (oral)  
 T.Yu. Magakian: "Joint researches of young stars in Byurakan: projects and first results" (oral)  
 A.M. Mickaelian: "French-Armenian collaboration on Virtual Observatories" (oral); "Webpage of the French-  
 Armenian collaboration in astronomy" (oral); "Recovery of asteroids in the Digitized First Byurakan  
 Survey" (poster)  
 T.H. Movsessian: "Scanning Fabry-Perot Observations of Herbig-Haro Jets" (oral)  
 A.G. Nikoghossian: "The French-Armenian Cooperation in Solar Physics" (oral)  
 E.H. Nikoghossian: "The multi-wave study of the active star-formation region in Cygnus 0137 complex" (oral)  
 G.A. Ohanian: "The Role of the Radio-loud Phase of Nuclear Activity in Galaxy Formation and Evolution"  
 (oral)  
 H.V. Pikichian: "On the Non-linear Problem of Diffuse Reflection-Transmission" (oral)  
 D.M. Sedrakian: "Covariant Formulation of Dynamical Equations of Quantum Vortices in Type II  
 Superconductors" (oral)  
 A.G. Yeghikian: "Radiation-induced Chemical Transformation of Ices in Protostellar Nebulae: when and  
 where Does Breaking of Molecular Symmetry Take Place?" (oral)

#### **Workshop on Grid technologies in frame of CSIT-2009 (1 oral contribution)**

- A.M. Mickaelian: "The Digitized First Byurakan Survey on ArmCluster"

#### **ADASS-XIX (1 poster)**

- A.M. Mickaelian: Spectra extraction and analysis software for the Digitized First Byurakan Survey (DFBS)  
 and research projects

#### **International conference dedicated to 100<sup>th</sup> anniv. of M. Vashakidze (3 oral contributions)**

- A.A. Hakobyan: Different Type of Supernovae. Stellar Population and Star Formation in Galaxies  
 A.G. Nikoghossian: The Principle of Invariance and Lagrangian Approach in Astrophysics  
 E.H. Nikoghossian: Multi-wave Study of the Active Star-formation Region in Cygnus 0137 Complex

#### **Workshop "Plate Archive Digitization and Preservation" (1 oral contribution)**

- A.M. Mickaelian: Armenian plate archives and digitization projects

### **Seminars**

- |                 |  |
|-----------------|--|
| 07.04, Byurakan | Arthur Nikoghossian: "Known and unknown principle of invariance"               |
| 14.04, Byurakan | Kamo Gigoyan: "FBS 2213+421: extremely red object with C-rich characteristics" |

00.04, Byurakan	Vigen Malumian: "The hypothesis of GPS and CSS radiosources and black holes"
00.05, Byurakan	Norair Asatryan: "Investigation of the variability of broad Hydrogen line profiles of active galaxies: new results on Markarian 6"
00.06, Byurakan	Ararat Yeghikian: "The spectrum of cosmic particles around G-type stars passing through nebulae: dosimetry"
22.06, Byurakan	Areg Mickaelian: "Proper motions of the FBS blue stellar objects"
14.07, Byurakan	Satenik Ghazaryan: "Euro-VO meeting on how to publish data in the VO" (ArVO group seminar)

On Nov 5, 2009, Lusine Sargsyan gave an invited seminar "Study of Infrared Sources" at Hamburger Sternwarte (HS), Germany

## Publications

During 2009, Byurakan astronomers published 27 papers in refereed journals, 4 in proceedings of meetings, 3 electronic catalogs, and 2 other publications. A number of information materials and popular articles were published as well.

### Refereed journal papers

**Nikoghossian, A.G.** – Ambartsumian's methods in the theory of radiative transfer // *Astrophysics*, Vol. 52, No. 1, p. 1-23, Jan 2009.

**Hakobyan, A.A.; Petrosian, A.R.;** Mamon, G.A.; McLean, B.; Kunth, D.; Turatto, M.; Cappellaro, E.; Mannucci, F.; Allen, R.J.; Panagia, N.; Della Valle, M. – Five supernova survey galaxies in the southern hemisphere. I. Optical and near-infrared database // *Astrophysics*, Vol. 52, No. 1, p. 40-53, Jan 2009.

**Adibekyan, V.Zh.;** Kazarian, M.A.; Karapetian E.L. – The morphological and spectral investigation of the galaxies Kaz 5, Kaz 92, and Kaz 390 // *Astrophysics*, Vol. 52, No. 1, p. 54-65, Jan 2009.

**Sinamyan, P.K.; Mickaelian, A.M.** – Progress in spectral studies of the FBS blue stellar objects // *Astrophysics*, Vol. 52, No. 1, p. 76-87, Jan 2009.

Aspin, C.; Beck, T.L.; Pyo, T.-S.; Davis, C.J.; Schieven, G.M.; Khanzadyan, T.; **Magakian, T.Yu.;** **Movsessian, T.A.;** **Nikogossian, E.G.;** Mitchison, S.; Smith, M.D. – Near-IR Spectroscopy of Young Stars in the Braid Nebula Star Formation Region in Cygnus OB7 // *Astron. J.*, Vol. 137, No. 1, p. 431-449, Jan 2009.

**Mickaelian A.M., Sargsyan L.A., Gigoyan K.S., Erastova L.K., Sinamyan P.K., Hovhannisyan L.R.,** Massaro E., Nesci R., Rossi C., Gaudenzi S., Sclavi S., Cirimele G., Weedman D., Houck J., Barry D., Sarkissian A., Thuillot W., Berthier J., Prugniel P., Kochiashvili I., Mikayelyan G.A. – Science with the Armenian Virtual Observatory (ArVO) // *Romanian Astron. J.*, Vol. 18, Suppl., p. 249-259, Jan 2009.

**Kalloghlian, A.T.** – Stellar associations // *Astrophysics*, Vol. 52, No. 2, p.157-167, Apr 2009.

**Gyulbudaghian, A.L.** – Star formation and molecular clouds // *Astrophysics*, Vol. 52, No. 2, p.168-183, Apr 2009.

**Adibekyan, V.Zh.;** **Petrosian, A.R.** – Study of the dependence of the star formation rate in the nuclear regions of 39 Kazarian galaxies on their integral parameters // *Astrophysics*, Vol. 52, No. 2, p.192-204, Apr 2009.

**Gyulzadian, M.V.;** **Petrosian, A.R.;** McLean, B. – Relationship of galaxies from the second Byurakan survey to Zwicky clusters. II. Discussion // *Astrophysics*, Vol. 52, No. 2, p. 205-216, Apr 2009.

**Yeghikyan, A.G.** – Irradiation of dust in molecular clouds. I. UV doses // *Astrophysics*, Vol. 52, No. 2, p. 288-299, Apr 2009.

Mas-Hesse, J.M.; Kunth, D.; Atek, H.; Ostlin, G.; Leitherer, C.; **Petrosian, A.;** Schaerer, D. – Local Lyman  $\alpha$  emitters and their relevance to high-redshift star-forming galaxies // *Astrophys. Space Sci.*, Vol. 320, No. 1-3, p. 35-38, Apr 2009.

**Hovhannisyan, L.R.; Mickaelian, A.M.;** Weedman, D.W.; Le Floch, E.; Houck, J.R.; Soifer, B.T.; Brand, K.; Dey, A.; Jannuzi, B.T. – Spitzer 24  $\mu\text{m}$  Excesses for Bright Galactic Stars in Boötes and First Look Survey Fields // *Astron. J.*, Vol. 138, No. 1, p. 251-261, July 2009.

**Sargsyan, L.A.;** Weedman, D.W. – Star Formation Rates for Starburst Galaxies from Ultraviolet, Infrared, and Radio Luminosities // *Astrophys. J.*, Vol. 701, No. 2, p. 1398-1414, Aug 2009.

**Harutyunyan, H.A.** – Ambartsumian's paradigm for the activity of galactic nuclei and the evolution of galaxies // *Astrophysics*, Vol. 52, No. 3, p. 307-321, Sep 2009.

**Akopian, A.A.; Parsamian, E.S.** – On the 100-th anniversary of the birth of Academician V.A. Ambartsumian. V.A. Ambartsumian and the statistics of flaring objects // *Astrophysics*, Vol. 52, No. 3, p. 322-334, Sep 2009.

**Erastova, L.K.** – Byurakan spectral sky surveys. Blue stellar objects in the strip at  $\delta=+47^\circ$  // *Astrophysics*, Vol. 52, No. 3, p. 369-376, Sep 2009.

**Sargsyan, L.A.** – Optical classification of 18 infrared galaxies // *Astrophysics*, Vol. 52, No. 3, p. 377-382, Sep 2009.

**Nikoghossian, A.G.** – Ambartsumian's invariance principle and some nonlinear relations in radiative transfer theory // *Astrophysics*, Vol. 52, No. 3, p. 431-439, Sep 2009.

**Gigoyan, K.S.;** Russeil, D.; Sarkissian, A.; **Sargsyan, L.A.** – FBS 2213+421, an extremely red object with C-rich characteristics // *Astrophysics*, Vol. 52, No. 3, p. 451-455, Sep 2009.

Ostlin, G.; Hayes, M.; Kunth, D.; Mas-Hesse, J.M.; Leitherer, C.; **Petrosian, A.;** Atek, H. – The Lyman Alpha Morphology of Local Starburst Galaxies: Release of Calibrated Images // *Astron. J.*, Vol. 138, No. 3, p. 923-940, Sep 2009.

**Mickaelian, A.M.;** **Sargsyan, L.A.;** Astsatryan, H.V.; Cirimele, G.; Nesci, R. – The DFBS Spectroscopic Database and the Armenian Virtual Observatory // *Data Sci. J.*, Vol. 8, p. 152-161, Sep 2009.

Kogoshvili, N.G.; Borchkhadze, T.M.; **Kalloghlian, A.T.** – Clustering of galaxies on scales of  $\leq 10 h^{-1}$  based on the Coma, Bridge, and A1367 clusters // *Astrophysics*, Vol. 52, No. 4, p. 482-493, Oct 2009.

**Malumian, V.H.** – GPS and CSS radio sources // *Astrophysics*, Vol. 52, No. 4, p. 494-500, Oct 2009.

**Nikoghossian, E.H.;** **Magakian, T.Yu.;** **Movsessian, T.A.;** Khanzadyan, T. – Search for HH-objects and emission stars in star formation regions. VI. Herbig-Haro objects and emission stars in the region of the GM 1-64 and GM 2-4 nebulae // *Astrophysics*, Vol. 52, No. 4, p. 501-511, Oct 2009.

**Movsessian, T.A.;** **Magakian, T.Yu.;** Moiseev, A.V.; Smith, M.D. – Herbig-Haro flows in 3D: the HH 83 jet // *Astron. Astrophys.*, Vol. 508, No. 2, p. 773-778, Dec 2009.

**Hakobyan, A.A.;** Mamon, G.A.; **Petrosian, A.R.;** Kunth, D.; Turatto, M. – The radial distribution of core-collapse supernovae in spiral host galaxies // *Astron. Astrophys.*, Vol. 508, No. 3, p. 1259-1268, Dec 2009.

### **Proceedings papers**

Sarkissian A., Forget F., Lebonnois S., Boudon V., Coustenis A., Pernot P., Dutuit O., Chassefiere E., Maattanen A., Thuillot B., Galstyan H., Hirtzig M., Mikayelyan G., Kochiashvili I., **Mickaelian A.**, Delcambre Y., Thauvin O., Boone C., Poulet N. (The Team for the Node Atmospheres of IDIS) – The Node Atmospheres of IDIS // *European Planetary Science Congress, EPSC*, Vol. 4, p. 426, Sep 2009.

Berthier, J.; Sarkissian, A.; **Mickaelian, A.;** Thuillot, W. – Recovery of asteroids in the Digitized First Byurakan Survey // *European Planetary Science Congress (EPSC), EPS*, Vol. 4, p. 526-527, Sep 2009.

**Mickaelian, A.M.;** Astsatryan, H.V.; Sahakyan, V.G.; **Sargsyan, L.A.;** Nesci, R.; Cirimele, G.; **Harutyunian, H.A.;** **Magakian, T.Yu.;** **Sinamyan, P.K.;** Mikayelyan, G.A. – The Digitized First Byurakan Survey on ArmCluster // *Proc. CSIT-2009 Conf.*, Vol. 7, p. 420-423, Oct 2009.

**Mickaelian, A.;** Kochiashvili, N.; Astsatryan, H.; **Harutyunian, H.;** **Magakyan, T.;** Chargeishvili, K.; Natsvlishvili, R.; Kukhianidze, V.; Ramishvili, G.; **Sargsyan, L.;** **Sinamyan, P.;** Kochiashvili, I.; Mikayelyan,

G. – Development of Armenian-Georgian Virtual Observatory // *Proc. CSIT 2009 Conf.*, Vol. 7, p. 424-427, Oct 2009.

### **Electronic catalogs**

**Petrosian, A.**; McLean, B.; Allen, R.J.; MacKenty, J.W. – Optical properties of Markarian galaxies (Petrosian et al., 2007) // *VizieR On-line Data Catalog: J/ApJS/170/33*. Originally published in: *2007ApJS..170...33P*, Apr 2009.

**Petrosian, A.**; McLean, B.; Allen, R.; Kunth, D.; Leitherer, C. – NGP+30° zone galaxies I. (Petrosian et al., 2008) // *VizieR On-line Data Catalog: J/ApJS/175/86*. Originally published in: *2008ApJS..175...86P*, June 2009.

Kazarian, M.A.; **Adibekyan, V.Zh.**; McLean, B.; Allen, R. J.; **Petrosian, A.R.** – Kazarian galaxies catalog (Kazarian et al., 2010) // *VizieR On-line Data Catalog: VII/254*. Originally published in: *Astrophysics (2010, in press)*, Nov 2009.

### **Other papers**

Kazarian, M.A.; **Adibekyan, V.Zh.**; McLean, B.; Allen, R.J.; **Petrosian, A.R.** – A catalog of Kazarian galaxies // *eprint arXiv:0912.2050*, Dec 2009.

Nesci, R.; **Mickaelian, A.**; Rossi, C. – A pre-outburst spectrum of KT Eri from the Digitized First Byurakan Survey (DFBS) // *Astronomer's Telegram*, #2338, 8 Dec 2009.

### **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 2009, 6 papers were published in AJ, ApJ, A&A, and MNRAS, including 4 in frame of INI (listed in “*Publications*”). The research staff (24): H.V. Abrahamian, T.G. Arshakian, 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, T.H. Movsessian, H.Kh. Navasardian, 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 Astrophysics: V.Zh. Adibekyan, A.A. Akopian, H.A. Harutyunian, T.Yu. Magakian, V.H. Malumian, A.M. Mickaelian, T.H. Movsessian, A.G. Nikoghossian, A.G. Yeghikyan. The Chair of Astrophysics formally joined with the Chair of General Physics in 2009 headed by **Prof. Davit Sedrakian**.

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

Three Ph.D. theses were defended at BAO Special Council in 2009:

April 27: **A.A. Hakobyan** (supervisor: A.R. Petrosian)

April 27: **V.Zh. Adibekyan** (supervisor: M.A. Kazarian)

June 15: **Zh. Martirosyan** (supervisor: M.A. Kazarian)

The fourth thesis by **L.A. Sargsyan** (supervisors: A.M. Mickaelian and D.W. Weedman) has also been accepted for defense.

At present BAO has only one Ph.D. student, S.A. Ghazaryan (supervisor: H.A. Harutyunian), who is involved in the joint French-Armenian post-graduate fellowship sponsored by the French Embassy in Armenia. Her second (French) supervisor is Georges Alecian. In addition, a few other

Byurakan fellows are in the stage of preparation of their Ph.D. theses: N.S. Asatrian, A.G. Eghikian, M.V. Gyulzadian, A.A. Karapetian, and P.K. Sinamyan.

The International Astronomical Olympiad was held in 2009 in China, where two Armenian pupils won First-rank Diploma (teacher: Marietta Gyulzadian).

## Membership

**International Astronomical Union (IAU, 17 members):** K.S. Gigoyan, A.L. Gyulbudaghian, H.A. Harutyunian, R.Kh. Hovhannessian, A.T. Kalloghlian, E.Ye. Khachikian, T.Yu. Magakian, A.P. Mahtessian, V.H. Malumian, N.D. Melikian, A.M. Mickaelian, A.G. Nikoghossian, E.S. Parsamian, A.R. Petrosian, H.V. Pikichian, V.A. Sanamian (retired), R.K. Shahbazian (retired)

**European Astronomical Society (EAS, 17 members):** A.S. Amirkhanian, R.R. Andreev, K.S. Gigoyan, H.A. Harutyunian, M.A. Hovhannissian, S.G. Iskudarian, E.Ye. Khachikian, T.Yu. Magakian, V.H. Malumian, N.D. Melikian, A.M. Mickaelian, T.H. Movsessian, E.H. 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):** 37 members from BAO

## Journal *Astrofizika/Astrophysics*

The journal *Astrofizika* (English translation: *Astrophysics*) is being published by the Armenian NAS. Five Byurakan astronomers are involved in the Editorial Board of *Astrofizika* (Editor-in-Chief: Prof. Davit Sedrakian from the YSU): **E.Ye. Khachikian** (*Deputy Editor-in-Chief*), **A.T. Kalloghlian** (*Secretary-in-Chief*), **H.A. Harutyunian**, **A.G. Nikoghossian**, and **E.S. Parsamian**. Four issues were published in 2009 with 51 papers, including 18 from BAO.

## Organizational and Public affairs

Most of the activities in frame of IYA-2009 were accomplished by BAO and ArAS. There was an IYA-2009 organizational committee headed by A.M. Mickaelian, where most of the members were from BAO. The year of 2009 was noted by an increase in public and popular activities related to astronomy. Most of the activities are listed in section “*Results of IYA-2009*”. The 3<sup>rd</sup> Byurakan International Summer School combined with the IAU 32<sup>nd</sup> International School for Young Astronomers (ISYA-2010) is being organized to be held on Sep 12 – Oct 2, 2010 in Byurakan (see section “*ISYA-2010 in Byurakan*”).

## 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: **T.H. Movsessian**, Webmaster: **G.A. Mikayelyan**. ArAS has 82 members. During 2009, New webpage, Newsletters, VIII meeting, Annual prize, new awards, new members (including foreign).

## Sponsors of BAO

We acknowledge support to our activities during 2009 from “**Vivacell MTS**” Company (President Ralph Yirikian), “**Antares**” Holding (President Armen Martirosyan), and “**Armenpress**” News Agency (Managing Director Hrayr Zoryan).

*Haik Harutyunian, Areg Mickaelian*

## FRENCH-ARMENAIN COLLABORATION WEBPAGE



French and Armenian astronomers have a long tradition of collaboration dating back to 1960s. Such famous scientists as Viktor Ambartsumian, Daniel Chalonge, Jean-Claude Pecker, Georges Courtes, Ludwik Mirzoyan, Agop Terzan, Zadig Mouradian, and others were involved. By the numbers of involved scientists, joint projects, mutual visits, publications, joint supervision of students, and almost by any other criterion it is the largest and the most efficient collaboration since the foundation of BAO. In addition, PICS and Jumelage projects were rather important to significantly activate the science in Byurakan, which was in a very heavy situation after the disintegration of the Soviet Union. Therefore, we found useful to create a webpage devoted to it. The contents were available for the coordinators of the collaboration in 1990s-2000s (Daniel Kunth, Artashes Petrosian, Georges Alecian, and Arthur Nikoghossian) and the Director of BAO (Haik Harutyunian) since May 2009 and later for all involved participants for comments, suggestions, and discussion. Though only a few more suggestions arrived, anyway they allowed improving the webpage and at last recently (05.02.2010) it was open on the ArAS webpage (available among the main menus).

French-Armenian collaboration webpage describes the history of mutual contacts, forms of the collaboration, PICS 1994-1996, Jumelage 1997-2003, PICS 2007-2009, CNRS-SCS grants in 2010-2011, collaboration of Virtual Observatories (OV-France and ArVO), other projects (INTAS, NATO, INSU/ANR, and FP7 Europlanet grants), joint supervision of Ph.D. students supported by the French Embassy in Armenia, technical developments (including the building of pointing/guiding system, focal reducer ByuFOSC, Fabry-Perot interferometer, multi-pupil spectrograph VAGR, and the aluminization plant for the BAO 2.6m telescope), participating institutes and scientists (15 institutions, 41 French and 29 Armenian scientists are listed), French-Armenian workshops in 1995 and 2009, participation of French astronomers in meetings held in Byurakan in 1956-2009, participation of Armenian students in summer schools held in France in 1996 and 2006, teaching of French lecturers at the Byurakan international summer schools in 2006/2008/2010, joint publications (totaling 142 and mostly in international refereed journals), and French astronomers of Armenian origin. At the end, photo gallery is given with photos showing joint research, meetings, and just friendship of the Armenian and French astronomers.

*Areg Mickaelian*

## RESEARCH GROUPS at BAO: ArVO GROUP



The Armenian Virtual Observatory (ArVO) research group was officially established at BAO in July 2005. Two circumstances supported this event: our previous research experience and achievements during 1990s and the beginning of 2000s and first contacts with the International Virtual Observatory Alliance (IVOA, created in 2002) community at JENAM-2004 in Granada, Spain. Almost immediately after its foundation, on July 20, 2005, ArVO was accepted in the IVOA as one of its (at present 17) national projects.

The scientists who entered the ArVO research group (A.M. Mickaelian, K.S. Gigoyan, L.K. Erastova, L.A. Sargsyan, P.K. Sinamyman, and L.R. Hovhannisyman) had experience of research in surveys (FBS blue stellar objects, FBS late-type stars, SBS, Byurakan-IRAS Galaxies and Stars, work with Hamburg Quasar Survey, ROSAT FSC sources), discovery of numerous objects, extensive work with astronomical databases and images (such as DSS1/DSS2, SIMBAD, NED,

Vizier, Aladin), using large catalogs (APM, MAPS, USNO, SDSS), efficient usage and comparative analysis of various data by cross-correlation of catalogs, they were the first to apply multiwavelength (MW) approach in their investigations (using data from X-ray to radio, and in particular introducing IR and X-ray astronomy in Byurakan), building MW spectral energy distributions (SED) to obtain possibly full understanding on any object, etc. In 2002, they conducted a big project for digitization of the FBS plates and creation of the spectroscopic database of the Digitized First Byurakan Survey (DFBS), as well as using its low-dispersion spectra for further science projects. DFBS project was accomplished in 2002-2005 in collaboration with Universita di Roma "La Sapienza" and Cornell University and an idea was put forward to start the Armenian Virtual Observatory (ArVO) project to utilize the DFBS and join the world VO community for further efficient research.

Though ArVO is mostly based on the DFBS, several other digitization projects have been undertaken, such as the Digitized Second Byurakan Survey (DSBS), digitization of photographic spectra of the FBS blue stellar objects taken with BAO 2.6m telescope, 1m Schmidt telescope Coma region plates with "chain" images, etc. These valuable databases should be the basis for the ArVO. Of course, ArVO has to create a standard environment for utilization of all these data and integration in the IVOA, as well as implement VO standards and tools created by other VO projects.

To present all these developments and especially the science projects and their results, recently the **ArVO research group webpage** was created and open (20.01.2010) at the ArAS website ([http://www.aras.am/Arvo\\_group/index.htm](http://www.aras.am/Arvo_group/index.htm)). It introduces the team members (including associated ones who work with ArVO group in frame of projects, altogether 9 scientists and 4 students), lists and describes research projects, facilities (16 ground-based and 3 space telescopes, 10 databases, and 3 most important astronomical software) used for research, collaboration (51 scientists from 19 foreign institutions), obtained results and achievements, list of publications with links to abstracts at ADS (60 papers in 2005-2009), academic visits (40) and invited seminars (14), participation in meetings (35) and summer schools (8), membership in 10 scientific organizations and societies, 15 committees and councils, 3 editorial boards, honours, awards, and grants, teaching activity, photo gallery, and contacts.

Among the most important matters concerning our research group I would like to especially mention here the initiated projects (such as optical identifications of IRAS and ROSAT sources, MW studies of galactic and extragalactic objects, selection and observations with Spitzer Space Telescope of highest IR/opt flux ratio extragalactic objects, etc.), discovery of thousands of new objects (QSOs, other AGN, cataclysmic variables, white dwarfs, hot subdwarfs, carbon stars, Mira variables, etc.), suggestion and development of new research methods, our group products during 2005-2009 (5 large catalogs, 3 important webpages, and the DFBS book), a number of received grants (CRDF, ISTC, ANSEF, PICS, DFG, DAAD, etc.), and very broad international collaboration with scientists from 11 countries (USA, France, Italy, Germany, UK, Greece, Russia, Georgia, Mexico, China, and Serbia). ArVO team members also are engaged in teaching and organizational activities. Most of them have additional duties in Byurakan, like Kamo Gigoyan is a fellow of the 2.6m telescope, Parandzem Sinamyan is the Head of BAO Photo Archive and the Chair of Young Astronomers Council, and Lusine Sargsyan and Lilit Hovhannisyan have been the Editors of ArAS Newsletters. There are several more new ideas and new research initiatives by our group that will be conducted in the nearest future.

*Areg Mickaelian,  
Project Manager of ArVO and Head of ArVO research group at BAO*

## VIKTOR AMBARTSUMIAN INTERNATIONAL PRIZE



**Viktor Ambartsumian International Prize** is one of the important awards in astronomy/astrophysics and related sciences. It is being awarded to outstanding scientists of any nationality having significant contribution in astrophysics, as well as those fields of physics and mathematics in which Ambartsumian had contributed. The Prize totals **USD 500,000** and is being awarded once each two years, starting with **2010**.

To apply for the Prize, a work may be presented by an author or authors' group (not more than 3 persons). The cash award is being equally shared between the winners, and a diploma, a medal and a certificate are being awarded to each winner.

**The right for the nomination of works is reserved to:** Nobel Prize Winners, Presidiums of national academies of sciences, scientific councils of astronomical observatories, and councils of corresponding departments of universities. A nomination for the application of V.A. Ambartsumian Prize is not allowed in case if his/her presented work has already been presented for another international prize.

**Necessary documents for nomination:** 1. Official letter of nomination, 2. Statement of scientific results or achievements, which are being nominated (up to 2 pages), 3. Curriculum Vitae of the nominee, 4. List of refereed publications of the nominee, 5. Published papers, books, CD/DVDs, or other material that are being nominated (PDF files are preferable), 6. Other documents that might be important for the decision. **Three letters of recommendation** directly sent to the committee are required.

**The documents should be submitted to:** V.A. Ambartsumian Prize Committee, Presidium of the National Academy of Sciences, Marshal Baghramyan ave. 24, Yerevan 0019, Armenia.

**Deadline for nominations:** March 18, 2010. The decisions will be made before July 18, 2010 and the award of Viktor Ambartsumian International Prize will take place on September 18, 2010.

**Viktor Ambartsumian International Prize Steering Committee:** Radik Martirosyan (Armenia, Chair), Norair Arakelyan (Armenia), Gennady Bisnovatyi-Kogan (Russia), Geoffrey Burbidge (USA, deceased), Catherine Cesarsky (France), Reinhard Genzel (Germany), Martin Rees (UK), Yervant Terzian (USA), Robert Williams (USA).

**Contact:** Areg Mickaelian (Scientific Secretary of Viktor Ambartsumian International Prize Committee, phone: +374-10-525505, +374-91-195914; e-mail: [aregmick@aras.am](mailto:aregmick@aras.am)). More details are available at our webpage <http://vaprize.sci.am/index.html>.

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## ISYA-2010 in BYURAKAN



The **3<sup>rd</sup> Byurakan International Summer School (3BISS)** will take place on 12 September – 2 October, 2010, in Byurakan (Armenia). It is combined with the **32<sup>nd</sup> International School for Young Astronomers (ISYA-2010)** and is being organized jointly by the International Astronomical Union (IAU), the Byurakan Astrophysical Observatory (BAO), and the Armenian Astronomical Society (ArAS).

Upper-level University students and post-graduate students are eligible to apply for participation. In exclusive cases, some excellent B.Sc. students will also be accepted. The students must have a working knowledge of English which will be the official language of the school, as well as sufficient level in physics and mathematics. A maximum of 30 students will be selected.

The IAU will cover travel expenses of the participants (visa, insurance, and air fare). BAO will provide free accommodation at the observatory hotel. ArAS provides meals and coffee breaks during the school, as well as other expenses (social events, participants' kits, administration expenses).

### Preliminary list of lecturers and lectures

**Dr. Georges ALECIAN** (OBSPM, Meudon, France): The chemically peculiar stars of the main sequence

**Dr. Tigran ARSHAKIAN** (MPIfR, Bonn, Germany): Future radio facilities: LOFAR, SKA and its pathfinders; Cosmic magnetism

**Dr. Igor CHILINGARIAN** (OBSPM, Paris, France and SAI, Moscow, Russia): Evolution of early-type galaxies from observations, simulations and Virtual Observatory

**Prof. Jean-Pierre DE GREVE** (Vrije Univ. Brussel, Belgium): Stellar Evolution; Close binaries

**Prof. Michel DENNEFELD** (IAP, Paris, France): Astronomical Instrumentation and Reduction Software

**Dr. Dieter ENGELS** (HS, Hamburg, Germany): Radio Astronomy

**Dr. Garik ISRAELIAN** (IAC, Canary Islands, Spain): Extrasolar Planets

**Dr. Daniel KUNTH** (IAP, Paris, France): Active Galactic Nuclei (AGN)

**Prof. Kam-Ching LEUNG** (Behlen Obs., Univ. Nebraska-Lincoln, USA): Astrophysics of Emission-Line Stars

**Dr. Gary MAMON** (IAP, Paris, France): Galaxy Formation

**Dr. Areg MICKAELIAN** (BAO, Byurakan, Armenia): Astronomical Surveys, Databases, Archives, and Virtual Observatories

**Dr. Elena NIKOGOSSIAN** (BAO, Byurakan, Armenia): Observational evidences of PMS stellar objects

**Prof. Alain SARKISSIAN** (Versailles St. Quentin Univ., LATMOS, France): Planetary Atmospheres

**Prof. Daniel WEEDMAN** (Cornell Univ., Ithaca, USA): Infrared Astronomy; Spitzer Space Telescope

**Prof. Robert WILLIAMS** (STScI, Baltimore, USA): Novae; HST science

**Prof. Lutz WISOTZKI** (AIP, Potsdam, Germany): Integral Field Spectroscopy; Extragalactic Surveys

### Announcements and Deadlines

October 29, 2009	1 <sup>st</sup> Announcement with call for Applications and webpage
<b>April 15, 2010</b>	<b>Deadline for Applications and Letters of Recommendation</b>
May 1, 2010	Applicants are informed about the outcome of decisions
May 1, 2010	2 <sup>nd</sup> Announcement with tentative program and list of participants
July 15, 2010	3 <sup>rd</sup> Announcement with detailed program
<b>12 Sep – 2 Oct, 2010</b>	<b>ISYA-2010 in Byurakan, Armenia</b>

### Contact

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Web page: [http://www.aras.am/SS2010/ss\\_index.htm](http://www.aras.am/SS2010/ss_index.htm)

## FELIX AHARONIAN: WINNER of AAS ROSSI PRIZE



The High-Energy Astrophysics Division of the American Astronomical Society (AAS/HEAD) has announced its highest award (Rossi prize) winners 2010. The 2010 Rossi prize is awarded to Felix Aharonian, Werner Hoffmann, Heinz Voelk, and the H.E.S.S. Collaboration for their outstanding contributions to imaging TeV Astronomy, which addressed fundamental questions related to particle acceleration and the origin of the Cosmic Rays through the study of Supernovae remnants (SNRs), pulsar wind nebulae (PWN) and nearby active galactic nuclei (AGNs). This award includes a monetary part as well as a lecture at the next AAS meeting in Seattle in January 2011.

Prof. Felix Aharonian is at present at Dublin Institute for Advanced Studies (DIAS) and simultaneously the leader of of High Energy Astrophysics Group at Max-Planck-Institut für Kernphysik (MPK), Heidelberg, Germany. He has an honorary status of an External Member of MPK. Since 2008 he is a foreign member of NAS RA and since 2004, member of ArAS.

We sincerely congratulate Felix Aharonian and his colleagues and wish them further success and new achievements.

## ANNIVERSARIES. Noreta ANDREASSIAN-THOMAS - 60

On the first day of this year **Prof. Noreta Andreassian-Thomas** celebrated her 60<sup>th</sup> anniversary. At present she is a professor at the University of the Virgin Islands (UVI). Noreta was born on January 1, 1950 in Yerevan. She studied at the Department of Physics of the Yerevan State University (YSU) in 1966-1971. After the graduation, Noreta started working at the extragalactic group of the Byurakan Observatory. However, since the student years she participated in observations and worked on study of the variable star  $\gamma$  Cas. Later (1974-1987) her main research was devoted to spectrophotometric investigation of M82 type irregular galaxies (together with US astronomers) and detailed spectrophotometric studies of some Markarian galaxies (together with Russian colleagues) and most of her papers she published on these subjects. Noreta defended her Ph.D. thesis in 1987. She also carried out some work on optical and radio observations of galaxies with Megamaser emission (1991) and on ultraluminous IRAS galaxies (1994). Altogether, she has published some 25 papers in *Astrophysics*, *Astron. Astrophys.*, and other journals. Such famous astrophysicists as Halton Arp (USA), Wallace Sargent (USA), and Danielle Alloin (France) are among Noreta's co-authors. Noreta is an ArAS member since 2007. Last time she visited Armenia in 2007 and participated in the Joint European and National Astronomical Meeting (JENAM-2007).

## ANNIVERSARIES. Alain SARKISSIAN - 50



Recently **Dr. Alain Sarkissian** celebrated his 50<sup>th</sup> anniversary. He is a senior astronomer at the Laboratory of Atmospheres, Environment, and Space Observations (Laboratoire Atmospheres, Milieux, Observation Spatiales – LATMOS), Paris, France and one of the most active Armenian astronomers living in France. He was born on January 31, 1960 in Paris, however studied at the Department of Physics of the Yerevan State University (YSU) in 1981-1986. Garik Israelian, Vahram Chavushian, and Elena Nikogossian were among Alain's friends at the YSU, though later moved to different institutions (IAC, Spain, INAOE, Mexico, and BAO, Armenia, respectively). After the graduation Alain returned to Paris and worked at first in the field of Earth

atmosphere, then planetary atmospheres and then astronomy. In 1996-2000 he was the coordinator of the project *"Polar Stratospheric Clouds"* (PSC) and has been coordinator and responsible of several other projects and instruments at Service d'Aeronomie, IPSL. At present Alain's main fields of investigation are planetary atmospheres and Virtual Observatories (VOs). Alain has been the supervisor of many students, he has organized a number of summer schools (particularly, ERCA schools) and practical courses for students at Observatoire de Haute Provence (OHP) and elsewhere. Alain was one of the initiators to start collaboration between the French and Armenian VO projects, which is mainly focused on implementation of the Digitized First Byurakan Survey (DFBS) in VO format and with VO tools. He is the leader of one of the thematic fields (*"Atmospheres"*) of the European Union FP7 (and before, FP6) Europlanet project *Integrated and Distributed Information Service* (IDIS). At present Alain collaborates with the Armenian Virtual Observatory (ArVO) team and significantly supports Armenian astronomers and students. Alain is a member of the group *"Planetary Database"* of CNES (French space agency, 2003), member of the ESA Topical Team *"Ices in Space"* (2001), an ArAS member (2009), member of a number of other organizations and committees.

## ANNIVERSARIES. George HERBIG - 90



Recently **Prof. George Herbig**, one of the most outstanding modern astronomers, celebrated his 90<sup>th</sup> anniversary. He is known for his discovery of the first "newborn" stars in the region of the Orion nebula. His studies showed areas of increased nebulosity due to bipolar outflow as a star is born, a phenomenon also described independently by the Mexican astronomer Guillermo Haro, and now called **Herbig-Haro** or **HH objects**.

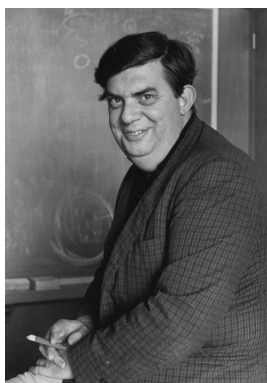
Herbig was born on Jan 2, 1920 in Wheeling, West Virginia, USA. He got his B.Sc. degree from the University of California at Los Angeles (1943) and Ph.D. in Astronomy from the University of California at Berkeley (1948). Then he worked as a scholar at Lick Observatory and simultaneously as a teacher (since 1966, Professor) of astronomy at University of California at Santa Cruz (1948-88), and professor of astronomy at the University of Hawaii (since 1988).

His main fields of investigation are Spectra of Variable and Peculiar Stars, Optical Absorption Spectra of Interstellar Material, and Early Stellar Evolution. Beside HH objects, he discovered a class of intermediate mass pre-main sequence stars at present named **Herbig Ae/Be stars**. Herbig has also made prominent contributions to the field of diffuse interstellar band (DIB) research, especially through a series of nine articles published in 1963-1995. He is the author of two books: *Parallaxes and Proper Motions of Prototypes of Astrophysically Interesting Classes of Stars* (1997) and *Historical Introduction to Star Formation* (2002).

*Prof. Herbig* was awarded the AAS Warner Prize in 1955, the ASP Catherine Bruce Gold Medal in 1980, Medaille de l'Université de Liège in 1969, Petrie Prize and Lectureship of the Canadian Astronomical Society in 1995. He is a member of several organizations and societies: American Academy of Arts and Sciences, National Academy of Sciences, Corresponding member of the Société Royale des Sciences de Liège, Foreign Scientific Member of Max-Planck-Institut für Astronomie, Heidelberg (Germany), and the AAS Henry Norris Russell Lecturer.

*Prof. Herbig* is a great friend of Viktor Ambartsumian (Ambartsumian gave the name *Herbig-Haro objects*) and Armenian astronomers in general. He has visited Armenia in 1956 to participate in the first international conference organized in Byurakan (official BAO inauguration meeting) on *Non-Stable Stars*.

## OBITUARIES: GEOFFREY BURBIDGE (1925-2010)



On Jan 26, 2010, **Prof. Geoffrey Burbidge**, one of the most outstanding modern astrophysicists, deceased at 84 in San Diego. He was known as a scientist who traced life to stardust. In recent years Burbidge was known mostly for his alternative cosmology “**quasi-steady state theory**”, which contradicts the Big Bang theory. According to Burbidge, the universe is oscillatory and as such expands and contracts periodically over infinite time. This theory, due to its controversial nature, has brought certain fame to Burbidge.

Burbidge was born on Sep 24, 1925 in England and educated at the University of Bristol and University College, London, where he earned his Ph.D. in theoretical physics in 1951. He said that he got into astronomy by marrying an astronomer (Margaret Burbidge). He worked at Harvard University, Yerkes Observatory, Cambridge University, Mt. Wilson and Mt. Palomar Observatories, and the California Institute of Technology, and he was at the University of California, San Diego from 1962 until his death, aside from six years (1978-84) as Director of the Kitt Peak National Observatory.

In 1957 he, Margaret Burbidge, William Fowler, and Fred Hoyle showed how all of the elements except the very lightest are produced by nuclear reactions in stellar interiors (so-called **B<sup>2</sup>FW** paper). He did extensive research into the physics of non-thermal radiation processes. He contributed to our knowledge of structures and masses of galaxies and of the physics and structure of quasars. He served from 1974-2004 as editor of the *Annual Reviews of Astronomy and Astrophysics*. He was a gadfly to cosmologists, frequently challenging the prevailing Big Bang models. In 2000, long after nearly all cosmologists had accepted the evidence for an evolving universe, he, Fred Hoyle, and Jayant Narlikar expressed continued support for a (quasi) steady state universe.

Burbidge was awarded the ASP Catherine Bruce Gold Medal in 1999, the AAS Helen Warner Prize in 1959 (with Margaret Burbidge), Indian National Science Academy Vainu Bappu Memorial Award in 1989. National Radio Astronomy Observatory (NRAO) Jansky Prize in 1985, and the Royal Astronomical Society (RAS) Gold medal in 2005 (with Margaret Burbidge).

To some extent, Burbidge was a supporter of V.A. Ambartsumian’s ideas on alternative explanation of energy sources and evolution of cosmic objects. Burbidge visited Armenia in 1966 for participation in the IAU Symposium #29 on *Non-Stable Phenomena in Galaxies*. Since 2009, Burbidge was a member of the International Steering Committee of Viktor Ambartsumian International Prize.