

BYURAKAN ASTROPHYSICAL OBSERVATORY in 2010: ANNUAL REPORT

Introduction



In 2010 we had ups and downs in the Byurakan observatory. We would like to mention that a small group of students started very serious activities in modernization of 1m Schmidt camera. All the engineering works are completed and in a few months this telescope will be controllable after more than 20 years of its stoppage. Unfortunately during 2010 we could not begin the installation of the aluminization plant and the 2.6m telescope continued its work with the main mirror which desperately needs a renovated aluminum surface. Moreover the main telescope of the observatory needs a cardinal renewal of the control system as far as the elemental base is designed on the basis of the 60s of the last century, which should be substituted with new ones. This is one of the most important works to be done in the nearest future.

As the most prominent event of the year 2010 for the BAO one should mention the third Byurakan International School for young astronomers organized jointly with the IAU. The Byurakan schools evidently became traditional and every year the number of applications increases. This is one of the most welcome tendencies we observed in 2010.

In 2010 at last the book *“Evolution of cosmic objects through their physical activity”* was published presenting the proceedings of the international conference devoted to the 100th anniversary of Viktor Ambartsumian (*Editors: H.A. Harutyunian, A.M. Mickaelian & Y. Terzian*).

Some international projects are initiated, which seems to be very promising but which slowed down and did not begin in the last year as we planned (especially the Italian-Armenian collaboration project). In any case we hope that these projects will progress and bring both new technical possibilities and new ideas for the further activities of BAO.

Structure of BAO and research staff

At present formally 67.5 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. The Basic Program is called *“Evolution of Cosmic Objects via their Activity”*. The greater part of researchers, 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). 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.

Research at BAO

The main fields of investigation at BAO relate to non-stable phenomena in the Universe. This includes studies of non-stable stars and related objects in the Galactic Astronomy and activity in galaxies in the Extragalactic Astronomy, as well as search for new objects and large surveys. In addition, a group of theoreticians is always active in Byurakan working on topics initiated by V.A. Ambartsumian (radiative transfer theory, principle of invariance). Several recent directions have been introduced during 1990s and 2000s, such as the Large-Scale Structure of the Universe and (alternative) Cosmology, Infrared Astronomy, X-ray Astronomy, Solar physics, Virtual Observatories (VOs). To describe the main results obtained during 2010, the abstracts of published papers are given.

Stars and Nebulae

Spectral observations of the eclipsing binary RY Sct

Melikian N.D., Tamazian V.S., Docobo J.A., **Karapetian A.A.**, **Kostandian G.R.**, **Samsonian A.L.** (Ap 53, 202, 2010)

Spectral observations of the eclipsing binary RY Sct during 2005 and 2009 on the 2.6-m telescope at the Byurakan Observatory are reported. Although RY Sct requires further, more detailed study, the present limited observations reveal a number of important aspects of this star. The maxima of the equivalent widths are observed close to the primary minimum, while their minima are detected at the brightness maximum, where the spectral lines have very narrow profiles. Emission in the HeI $\lambda 6678\text{\AA}$ line was seen throughout the observation period, but transforms into weak absorption halfway between the secondary minimum and the maximum. The observed P Cyg type changes in the profile of some lines indicates a variable outflow of mass from the star. Estimates of the average velocity based on the blue components of the absorption lines yield roughly 400 km/s. The main observational characteristics of RY Sct are closely related to its orbital period. In all likelihood, its complicated spectrum and features are at least partially caused by intense, variable outflows of matter.

EMCCD Speckle Interferometry with the 6m Telescope: Astrometric Measurements, Differential Photometry, and Orbits

Docobo J.A., Tamazian V.S., Balega Y.Y., **Melikian N.D.** (AJ 140, 1078, 2010)

Results of the EMCCD-based speckle interferometric observations and differential photometry for 46 visual binaries obtained in 2007 June and July with the 6 m telescope of the Special Astrophysical Observatory (Russia) are presented. First preliminary orbits for COU 401, COU 1281, and COU 1037 as well as improved orbits for CHR 137, COU 100, COU 1136, COU 798, CHR 51, CHR 55, COU 315, COU 206, and ADS 13961, along with their dynamical mass estimates, are reported. On the basis of dynamical parallax information, first distance estimates for COU 100, COU 1136, COU 798, COU 206, and COU 1037 are calculated.

Spectral and photometric observations of TT Ari. III.

Melikian N.D., Tamazian V.S., Docobo J.A., **Karapetian A.A.**, **Kostandian G.R.**, Henden A.A. (Ap 53, 373, 2010)

The nova-like cataclysmic variable (CV) TT Ari was detected in its second deep minimum in November 2009. Study of its evolutionary phase is very important for research on the nature of CVs in the VY Scl group. During this phase the spectral energy distribution of the star changed rapidly. The emission lines of elements with high excitation, such as HeII $\lambda 4686$ and NIII/CIII, as well as broad absorption in the hydrogen Balmer series, originating in the photosphere of the white dwarf or in the lower layers of an accretion disk, vanished. The average ratio of the intensities of the Balmer series emission lines in the normal state and in the deep low state can be explained in terms of a simple photoionization-recombination model. At the same time, the intensity ratios of the triplet-singlet levels of neutral helium, HeI $\lambda 5876$ / HeI $\lambda 6678$, differ greatly in the normal state of the star and in its deep minimum. In the deep minimum, the star's spectrum contains only a very faint trace of the G band at a wavelength $\lambda 4300\text{\AA}$, together with flarelike events with amplitudes up to $\Delta m \approx 2^m.0$ or greater. These and some other observed characteristics indicate that during the deep minimum it is mainly emission from the secondary companion of the binary system, which is probably a T Tau star of an early K spectral class that is observed.

IRAS F18187+6304: a puzzling emission line star

Rossi C., Gaudenzi S., Frasca A., Spezzi L., Nesci R., Sclavi S., Magazzu A., **Mickaelian A.**, **Gigoyan K.** (Mem.S.A.It. S14, 127, 2010)

We observed in the optical range the strong infrared source IRAS F18187+6304 in the context of a program aimed to clarify the nature of the stellar objects of the Byurakan Infrared Source catalogue. The optical spectrum is characterized by continuum and absorption lines typical of early K-type giants plus a few permitted and forbidden emission lines. The sparse optical photometry did not put in evidence strong variations during the last 50 years. Our repeated observations indicate a substantial stability of the spectra and a monotonic increase of the luminosity in the BVR bands of about 0.4 magnitudes between Summer 2007 and Fall 2008. From a high resolution spectrum we measured a heliocentric radial velocity of -25 km/s and discovered a complex NaI-D structure resembling that of some T Tauri stars, the infrared CaII triplet is in absorption. A strong IR excess in the IRAS bands indicates a substantial quantity of circumstellar dust and gas. IRAS F18187+6304 is an isolated star at quite high galactic latitude, far from any star forming region. All these characteristics make this object an intriguing case of difficult interpretation. The preliminary results are discussed in the framework of the available synthetic energy distribution and accretion models.

Late-type stars found in the DFBS

Gigoyan K.S., **Sinamyan P.K.**, Engels D., **Mickaelian A.M.** (Ap 53, 123, 2010)

A list of comparatively faint late M and Carbon type stars detected on the Digitized First Byurakan Survey (DFBS) spectral plates in the zone with $+45^\circ \leq \delta \leq +49^\circ$ covering 684 deg^2 is presented. Accurate DSS2 positions, USNO-B1.0 B and R magnitudes, 2MASS near-infrared J, H, and K_s photometry, IRAS PSC/FSC fluxes (when available), approximate spectral types, and luminosity class estimates are given for 72 objects. Nine of them are newly confirmed carbon stars and 63 are M-type stars. For seven Mira variables with known pulsation periods we determined distances of 2-8 kpc using a period-luminosity relation. Distances of 17-115 pc for five M dwarfs, classified on the base of detected proper motions, were estimated using a color-luminosity relation. The object FBS 0845+466 is classified as a candidate carbon dwarf with distance $r \approx 72 \text{ pc}$.

New H α stars. Cyg OB7 region. I.

Melikian N.D., **Karapetian A.A.** (Ap 53, 490, 2010)

Preliminary results from a search for emission stars in the neighborhood of Cyg OB7 are reported. A new region of size $14 \times 14 \text{ arc min}$ lies 12 arcmin to the south of HH 448. 17 new objects have been found, of which one is related to a nebula with an interesting shape and, apparently, the characteristics of a cometary nebula. Inside the nebula there are 4 faint, compact formations with very high proper motions. The spectrum of a star shows that it is of spectral class K9-M0 and is a T Tau type star at a distance of 220 pc. Most of the discovered stars with a strong or intermediate H α emission line intensity are presumably also T Tau stars. This region appears to be a continuation of the T association around HH 448.

A Wide-Field Narrowband Optical Survey of the Braid Nebula Star Formation Region in Cygnus OB7

Magakian T.Yu., **Nikogossian E.H.**, Aspin C., Pyo T.-S., Khanzadyan T., **Movsessian T.**, Smith M.D., Mitchison S., Davis C.J., Beck T.L., Moriarty-Schieven G.H. (AJ 139, 969, 2010)

We study the population of Herbig-Haro (HH) flows and jets in an area of Cygnus OB7 designated the Braid Nebula star formation region. This complex forms part of the L 1003 dark cloud, and hosts two FU Orionis (FUor)-like objects as well as several other active young stars. To trace outflow activity and to relate both known and newly discovered flows to young star hosts we intercompare new, deep, narrowband H α and [S II] optical images taken on the Subaru 8 m Telescope on Mauna Kea, Hawaii. Our images show that there is considerable outflow and jet activity in this region suggesting the presence of an extensive young star population. We confirm that both of the FUor-like objects drive extensive HH flows and document further members of the flows in both objects. The L 1003 star formation complex is a highly kinematically active region with young stars in several different stages of evolution. We trace collimated outflows from numerous young stars although the origin of some HH objects remains elusive.

Cyclic flaring activity of flare stars

Akopian A.A. (Ap 53, 544, 2010)

Methods of detecting probable cycles in the flaring activity of flare stars and determining the cycle durations are examined. A new method of detecting a cycle of flaring activity and determining its duration is proposed assuming periodic flaring activity. This method is applied to two stars from the list of flare stars in the Pleiades cluster, Ton91 and Ton377. Variable flaring activity is found in both stars and the periods are estimated to be $P=15.2$ and 17.7 years for Ton91 and Ton377, respectively.

Southern YSO GRV10 and its environment

Gyulbudaghian A.L., May J. (Ap 53, 503, 2010)

In this paper the southern cometary nebula GRV10 and its environment are investigated. The object is connected with a molecular cloud (its dimensions are ~ 4 pc). 12CO (1-0) observations toward GRV10 revealed the presence of two molecular outflows (a bipolar outflow), a red and a blue-shifted outflow, which coincide in position, indicating that they are moving along the line of sight in opposite directions. Near GRV10 a bright IR star, GRV10 IR, is discovered (near the southern edge of the nebula) and since its spectra and near IR colors favor it to be a Mira type star, a distance of ~ 4.4 kpc can be estimated. Star GRV10 IR appears connected with the IRAS point source IRAS 10406-6256. The grouping of stars (YSOs - young stellar objects) connected with GRV10 and embedded in a dark nebulosity is also discussed. This grouping is associated with the IRAS point source IRAS 10406-6253, which has FIR colors typical for embedded, not evolved, YSOs.

Relationship of groups of submillimeter starless condensations to radial systems of dark globules

Gyulbudaghian A.L. (Ap 53, 112, 2010)

The recently discovered groups of submillimeter starless condensations at the junction of HII regions and molecular clouds, which are invisible in the optical and near IR ranges, are similar in many ways to visible radial systems of dark globules, specifically, in their densities of molecular hydrogen, sizes, proximity to bright stars of early classes (which may be responsible for their formation), etc. It is proposed that the groups of submm starless condensations are radial systems of dark globules that are optically invisible because they lie behind dark clouds. Thus, it is shown that these groups of condensations are not a new type of object.

Extragalactic Astronomy

Morphology of Markarian galaxies in single galaxies and groups

Mahtessian A.P., Movsessian V.H. (Ap 53, 570, 2010)

The morphological content of Markarian galaxies (MG) in groups and in single galaxies is examined. It is found that MG do not conform to the long established rule that the relative number of elliptical and lenticular galaxies in groups is higher than in single galaxies.

ROSAT source 1RXS J181333.7+453118, a Seyfert galaxy

Gigoyan K.S., Movsessian T.A., Hambaryan V.V. (Ap 53, 302, 2010)

The ROSAT source 1RXS J181333.7+453118 is a Seyfert Sy1 galaxy with a red shift of $z=0.093$. A ROSAT spectrum and a spectrum over wavelengths of $\lambda 4500-7250\text{\AA}$ taken with the 2.6-m telescope at the Byurakan Astrophysical Observatory are shown. The x-ray spectrum has characteristics similar to an AGN with a soft x-ray excess.

High surface brightness Arakelian galaxies and their environment

Mahtessian A.P., Movsessian V.H. (Ap 53, 163, 2010)

The relationship of high surface brightness Arakelian galaxies (ArG) to their environment is studied. This is done using the groups identified by the authors on the basis of the CfA2 red shift survey. Of the 15577 galaxies in the sample, 172 (1.104%) have a high surface brightness. The corresponding percentage for the galaxies with $13.0 < m \leq 15.0$ is 2.05. The following results are obtained: (a) On going from single to poor groups and on to more populated groups, the frequency of occurrence of ArG does not vary. (b) Groups of galaxies containing ArG do not differ on the average from groups which do not contain such galaxies in terms of their dynamic characteristics, such as the dispersion in radial velocity, size, and total luminosity, or their morphological content. (c) ArG do not follow the regular pattern according to which elliptical and lenticular galaxies are more often encountered in groups of galaxies than among single galaxies, i.e., it seems that the frequency of occurrence of elliptical and lenticular ArG in groups is the same as in single galaxies. (d) The surface brightnesses, diameters, and luminosities of ArG in groups of galaxies are greater than those of single ArG. This shows up especially strongly in spiral ArG.

Spectral observations of BIG objects

Mickaelian A.M., Sargsyan L.A. (Ap 53, 483, 2010)

This is a summary and general analysis of optical spectroscopic data on 172 BIG (Byurakan-IRAS Galaxies) objects obtained with the BAO 2.6-m, SAO 6-m, and OHP 1.93-m telescopes. 102 galaxies with star formation regions, 29 galaxies with active nuclei, and 19 galaxies with a composite spectrum were identified. The spectra of 12 of the galaxies show signs of emission, but without the possibility of a more precise determination of their activity class, 9 galaxies appear to have star formation rates that do not exceed normal, and 1 is an absorption galaxy. In order to establish the nature of these galaxies and the place they occupy in the general picture of the evolution of the universe, we compare them with 128 infrared galaxies.

Comparing Ultraviolet- and Infrared-selected Starburst Galaxies in Dust Obscuration and Luminosity

Sargsyan L.A., Weedman D.W., Houck J.R. (ApJ 715, 986, 2010)

We present samples of starburst galaxies that represent the extremes discovered with infrared and ultraviolet observations, including 25 Markarian galaxies, 23 ultraviolet-luminous galaxies discovered with GALEX, and the 50 starburst galaxies having the largest infrared/ultraviolet ratios. These sources have $z < 0.5$ and cover a luminosity range of $\sim 10^4$. Comparisons between infrared luminosities determined with the 7.7 μm polycyclic aromatic hydrocarbon feature and ultraviolet luminosities from the stellar continuum at 153 nm are used to determine obscuration in starbursts and dependence of this obscuration on infrared or ultraviolet luminosity. A strong selection effect arises for the ultraviolet-selected samples: the brightest sources appear bright because they have the least obscuration. Obscuration correction for the ultraviolet-selected Markarian+GALEX sample has the form $\log[\text{UV}(\text{intrinsic})/\text{UV}(\text{observed})] = 0.07(\pm 0.04)M(\text{UV}) + 2.09 \pm 0.69$ but for the full infrared-selected Spitzer sample is $\log[\text{UV}(\text{intrinsic})/\text{UV}(\text{observed})] = 0.17(\pm 0.02)M(\text{UV}) + 4.55 \pm 0.4$. The relation of total bolometric luminosity L_{ir} to $M(\text{UV})$ is also determined for infrared-selected and ultraviolet-selected samples. For ultraviolet-selected galaxies, $\log L_{\text{ir}} = -(0.33 \pm 0.04)M(\text{UV}) + 4.52 \pm 0.69$. For the full infrared-selected sample, $\log L_{\text{ir}} = -(0.23 \pm 0.02)M(\text{UV}) + 6.99 \pm 0.41$, all for L_{ir} in L_{sun} and $M(\text{UV})$ the AB magnitude at rest frame 153 nm. These results imply that obscuration corrections by factors of 2-3 determined from reddening of the ultraviolet continuum for Lyman break galaxies with $z > 2$ are insufficient, and should be at least a factor of 10 for $M(\text{UV}) \sim -17$, with decreasing correction for more luminous sources.

List of groups of galaxies based on the CfA2 redshift survey

Mahtessian A.P., Movsessian V.G. (Ap 53, 70, 2010)

Groups of galaxies are identified on the basis of the CfA2 redshift survey and a method proposed by one of the authors. Of the 15577 galaxies that have redshifts of 1000-15000 km/s and lie at galactic latitudes $|b_{\text{ll}}| \geq 20^\circ$, 1971 groups with $n \geq 2$ members were found, with a combined total number of 6787 members. The remaining 8790 (56.4%) galaxies constitute a sample of "single," isolated galaxies. The dispersion in the radial velocities of the groups and their radii are found to depend weakly on the distance to the observer.

Surveys and Databases

Proper motions and natures of First Byurakan Survey blue stellar objects

Mickaelian A.M., Sinamyam P.K. (MNRAS 407, 681, 2010)

A new method for combined calculations of proper motions (PMs) based on accurate measurements of POSS1 and POSS2 epoch plates is given. The positional accuracy of various surveys and catalogues is estimated, and statistical weights for each of them are established. To achieve the best positions, weighted averaging of direct measurements on DSS1/DSS2, and data from APM, MAPS, USNO-A2.0, USNO-B1.0 and GSC 2.3.2 catalogues were used. The rms accuracy of positions achieved for POSS1 is 119 mas in each coordinate and 168 mas total, and for POSS2 it is 69 mas in each coordinate and 98 mas total. Using these accurate positions and the large separation in years between POSS1 and POSS2, we calculated the best possible PMs: 3.9 mas yr⁻¹ in each coordinate and 5.5 mas yr⁻¹ total. We developed methods to control and exclude the accidental errors that appear in any survey. We compared and combined our PMs with those given in USNO-B1.0, SDSS DR7 and Tycho-2 catalogues and obtained even better results: 3.0 mas yr⁻¹ in each coordinate and 4.2 mas yr⁻¹ total PM. This approach was applied to the First Byurakan Survey blue stellar objects, containing significant numbers of white dwarfs and subdwarfs. In total, 640 objects were revealed with $\text{PM} \geq 10$ mas yr⁻¹, the detection limit for this method, and an electronic table of these objects is given. For more confident PMs, we adopt the limit 20 mas yr⁻¹ (333 objects). Adopting a 50 km s⁻¹ upper limit for tangential velocities, we calculated maximum distances and absolute magnitudes and estimated luminosity types for these objects, obtaining 185 probable white dwarfs ($M > 8^{\text{m}}$), 69 possible white dwarfs ($6^{\text{m}} < M < 8^{\text{m}}$), and 42 candidate subdwarfs/white dwarfs ($3^{\text{m}} < M < 6^{\text{m}}$). Given that we rediscovered 141 genuine white dwarfs among the classified objects, the success rate for the discovery of white dwarfs is estimated as 83 per cent, and as 38 per cent for our probable and possible white dwarfs, respectively.

A catalog of Kazarian galaxies

Kazarian M.A., Adibekyan V.Zh., McLean B., Allen R.J., Petrosian A.R. (Ap 53, 57, 2010)

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 J_{pg} (blue), F_{pg} (red), and I_{pg} (NIR) band photographic sky survey plates obtained by the Palomar and UK Schmidt telescopes. We provide accurate coordinates, morphological types, 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 Kazarian galaxies in different systems of

galaxies and about revised activity classes and redshifts. An atlas of several interesting subclasses of Kazarian galaxies is also presented.

Theoretical Astrophysics

On determining the microturbulent velocities of solar prominences

Nikoghossian A.G., Mouradian Z. (Ap 53, 387, 2010)

The classical method for determining the velocities of microturbulent motions in solar prominences is generalized to account for the possible opacity of the spectral lines. A new characteristic of a line is introduced which, for a given line formation mechanism, can be used to determine the optical thickness of the emitting region. The method is applied to lines in the EUV region observed with the SUMER spectrograph as part of the SOHO space program. Comparison with observational data not only confirms the validity of this mechanism for line formation, but also shows that the optical thickness of the medium is small for these lines. Difficulties involved in determining the kinetic temperature and, therefore, the microturbulent velocities, are discussed. Based on lines of various ions, this velocity is estimated to be on the order of 30-40 km/s.

Nonlinear diffuse reflection and transmission of radiative energy by a layer of finite thickness

Pikichian H.V. (Ap 53, 251, 2010)

The major results for the linear problem of diffuse reflection and transmission of radiation by a layer of finite thickness are carried over to the nonlinear case by successive application of Ambartsumian's approach for a one dimensional anisotropic medium. Formulas are given for nonlinear addition of layers which can be used to construct recurrence calculation procedures for uniform, periodic, and arbitrary stratified media. A complete set of differential equations for invariant imbedding is derived with the aid of these formulas. These equations are used to obtain a system of total invariance equations, which, in turn, offer the possibility of reducing the nonlinear problem of diffuse reflection and transmission during irradiation of a layer from both sides to the simpler problem of illuminating this medium from only one side, with the thickness of the layer remaining only as a fixed parameter. Finally, it is shown that the results obtained for the single frequency case (two-level atom) remain valid in the polychromatic case (multilevel atom), which is important for interpreting astrophysical data.

Gravitation and inertia; a rearrangement of vacuum in gravity

Ter-Kazarian G. (ApSS 327, 91, 2010)

We address gravitation and inertia in the framework of a general gauge principle (GGP) which accounts for the gravitation gauge group G_R generated by a hidden local internal symmetry implemented on the flat space. Following the method of phenomenological Lagrangians, we connect the group G_R to a non-linear realization of the Lie group of the distortion G_D of the local internal properties of six-dimensional flat space, M_6 , which is assumed as a toy model underlying four-dimensional Minkowski space. We study the geometrical structure of the space of parameters and derive the Maurer-Cartan's structure equations. We treat distortion fields as Goldstone fields, to which the metric and connection are related, and we infer the group invariants and calculate the conserved currents. The agreement between the proposed gravitational theory and available observational verifications is satisfactory. Unlike the GR, this theory is free of fictitious forces, which prompts us to address separately the inertia from a novel view point. We construct a relativistic field theory of inertia, which treats inertia as a distortion of local internal properties of flat space M_2 conducted under the distortion inertial fields. We derive the relativistic law of inertia (RLI) and calculate the inertial force acting on the photon in a gravitating system. In spite of the totally different and independent physical sources of gravitation and inertia, the RLI furnishes a justification for the introduction of the Principle of Equivalence. Particular attention is given to the realization of the group G_R by the hidden local internal symmetry of the abelian group $U^{loc} = U(1)_Y \times \text{diag}[SU(2)]$, implemented on the space M_6 . This group has two generators, the third component T^3 of isospin and the hypercharge Y , implying $Q^d = T^3 + Y/2$, where Q^d is the distortion charge operator assigning the number -1 to particles, but +1 to anti-particles. This entails two neutral gauge bosons that coupled to T^3 and Y . We address the rearrangement of the vacuum state in gravity resulting from these ideas. The neutral complex Higgs scalar breaks the vacuum symmetry leaving the gravitation subgroup intact. The resulting massive distortion field component may cause an additional change of properties of the spacetime continuum at huge energies above the threshold value.

On a possible source of energy for the ejection of matter from cosmic objects

Harutyunian H.A. (Ap 53, 311, 2010)

The transformation of the energy of an accelerating, expanding universe into internal energy of cosmic objects is discussed. The well known fact that Hubble expansion is observed on scale lengths two or more orders of magnitude smaller than the "cells of homogeneity" is taken into account, along with observational data indicating that this expansion also takes place on the scale of the solar system. Changes in the potential energy of individual model objects are examined on this basis and it is shown that the potential energy increases, thereby threatening the continued existence of these objects. An

expression is obtained for the mass which can attain the escape energy within a given energy accumulation time. Some estimates are made for the assumed masses of galactic clusters. Over a period of 10^7 years a protocluster can accumulate enough energy for ejection of a clump of matter with a mass equal to that of our galaxy.

Meetings held in Byurakan

Armenian Astronomical School Olympiad, 3 May 2010

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

Summer Practice for students of the YSU Department of Physics, July 2010

Traditional summer practice for the 3rd year students of the YSU Department of Physics.

Third Byurakan International Summer School combined with 32nd International School for Young Astronomers (ISYA), 12 Sep – 2 Oct 2010

International Summer school for M.Sc. and Ph.D. students and postdocs, the biggest one in the history of BAO. 49 students and 19 lecturers were present.

ArAS IX annual meeting, 26 Nov 2010

ArAS IX annual meeting was only an administrative one, without a scientific session. ArAS annual report and discussions were held.

ISYA-2010

The International School for Young Astronomers (ISYA-2010) was held in Byurakan on Sep 12 – Oct 2. It was organized jointly by the International Astronomical Union (IAU), BAO and ArAS. It was the IAU 32nd International School for Young Astronomers (ISYA-2010) and the 3rd Byurakan International Summer School (3BISS). The school was a great success and broke several records for the whole history of ISYAs. Altogether, 49 students from 19 countries took part, which was the largest number of representation by countries (Albania, Armenia, Czech Republic, Egypt, France, Georgia, Germany, Greece, Hungary, India, Iran, Lithuania, Poland, Romania, Russia, Serbia, Spain, Turkey, Ukraine). Taking into account the lecturers, two more countries were represented (USA and Belgium) thus bringing the total number to 21. 32 of the students were foreign ones selected out of 117 applications, also the largest number in the history. At last, female participation was 52%, another record.

A number of well-known scientists were invited to lecture during the school on various interesting topics. Altogether, there were 19 lecturers from 7 countries (Armenia, Belgium, France, Germany, Russia, Spain, and USA), including the IAU President *Prof. Robert Williams*, the Chair and Vice-Chair of the IAU ISYA Program Group *Prof. Jean-Pierre de Greve* and *Prof. Kam-Ching Leung*, organizer of the ESO NEON schools *Prof. Michel Dennefeld*, organizer of the Byurakan International Summer Schools *Dr. Areg Mickaelian*, other famous scientists, such as Daniel Kunth, Dieter Engels, Gennady Bisnovaty-Kogan, Lutz Wisotzki, Garik Israelian, Gary Mamon, et al.

The school lasted 3 weeks; 36 lectures on various topics of modern astrophysics, 12 practical exercises on optical, IR, and radio reduction software and some others, observations with BAO 2.6m and 0.45m, as well as remote observations with 2.2m Faulkes North (Hawaii) and South (Australia) telescopes, students' scientific presentations on their research topics and obtained during the school results, numerous discussions were carried out, as well as tours to Armenian sightseeing, participation in the Viktor Ambartsumian International Prize Award Ceremony in Yerevan, sports games, competitions, banquets, and other social events. All lectures were written on DVDs and distributed to students. The students' presentations are available on the ISYA official webpage.

The Closing Ceremony was held on Oct 1, including a summary and discussions, a photo report on ISYA-2010 events, award of the students certificates by lecturers, award of a number of prizes established for the most active students, award of ArAS membership cards to new ArAS members (ISYA-2010 participants *Dr. Dieter Engels* and *Arun Kumar Singh*), a presentation of *Vahradyans'* booklet on *Karahunge*, and a small violin and clarinet concert with compositions of *Edward Manukyan* dedicated to famous scientists.

Among the main results we would like to mention the most important: 1) by organization of such an important international meeting, Armenia confirmed its role in the Middle East region as a regional astronomical centre, 2) a number of important guests were present, including the President of the International Astronomical Union (IAU) *Prof. Robert Williams*. BAO and Armenia are now being regarded as one of the active astronomical centers, 3) such activities are beneficiary for all Armenian astronomers and the Armenian astronomy in general from the international point of view, 4) typically, 1-2 Armenian students are able to attend international astronomical schools organized worldwide. And now, 20 Armenian students at once had chance to participate in such an important international school, 5) the participants (the students) represented 19 nations, and going back to their home institutions they will implement the lessons learnt in *Byurakan*.

At modern meetings, high-speed Internet access is crucial, and it was especially important for the ISYA-2010 as they were a number practical exercises using online access to databases and astronomical software. Before there was only Internet at the main administrative building of BAO, and it would be a big problem for the school program, as most of the lectures and practical exercises were out of this building. Using the UNESCO funds and a sponsorship by "Unicomp" JCSC, Wi-Fi Internet was installed over the whole territory of BAO, including the conference hall and the hotel. The same Internet problems were crucial to make online observations at daytime in *Byurakan* with telescopes on *Hawaii* and in *Australia*. These were first such remote observations from *Byurakan*. Due to some efforts, the problems were solved as well.

Byurakan International Summer Schools program is ongoing and every two years we organize such a school. We started such a program in 2006, and this was the third one. In addition, the IAU has now accepted a strategic plan for *Global Astronomy Development* for 2011-2020, and regional offices will be established for its activities. Armenia (the *Byurakan Observatory*) is one of the candidates for holding such an office. Summer schools program will be attached to such *Regional Offices*. There was a preliminary agreement with the IAU ISYAs program Chair *Prof. Jean-Pierre de Greve* to organize another ISYA in *Byurakan* in 2014.

The school was sponsored by the *IAU*, *BAO*, *ArAS*, *UNESCO*, *the Armenian National Academy of Sciences (NAS RA)*, *Armenian State Committee for Science (SCS)*, *Armenian National Foundation of Science and Advanced Technologies (NFSAT)*, *German Academic Exchange Service (Deutscher Akademischer Austausch Dienst, DAAD)*, *UNICOMP CJSC*, *Yerevan "Ararat" Brandy Company*, *"Antares" Holding*, *"Armenpress" News Agency* (information sponsor).

Research grants

International research grants support the research at BAO and are a significant contribution compared to the low level of national funding. In 2010, following projects were active:

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 (2010): “Different Type of Supernovae, Stellar Population and Star Formation in Galaxies”, PI: **A.A. Hakobyan**; “Two-point correlation functions of groups and clusters of galaxies, radio galaxies and quasars”, PI: **A.P. Mahtessian**

CNRS-SCS (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, 17 Byurakan scientists had 33 academic visits to astronomical centres of 13 countries (USA, France, Germany, Italy, Spain, Portugal, Belgium, Switzerland, Vatican, Russia, Ukraine, India, and South Africa) (compared to 17 visits to 6 countries by 11 scientists in 2009). As before, most active collaboration was with French institutions (altogether 12 visits of 8 scientists). Five times Armenian scientists visited USA, three times Russia, twice – Germany, Italy, Switzerland, and Ukraine (each).

Artashes Petrosian	StScl, USA	2 months	2009 -01.03
Kamo Gigoyan	Rome, Italy	2 weeks	15.01-01.02
Tigran Movsessian	SAO, Russia	1 week	05.02-12.02
Haik Harutyunian	Pescara, Rome, Italy	2 weeks	06.02-16.02
Lusine Sargsyan	Cornell Univ., USA	1 month	28.02-31.03
Areg Mickaelian	Cape Town, South Africa	1 week	12.03-21.03
Satenik Ghazaryan	Les Diablerets, Switzerland	1 week	12.03-21.03
Satenik Ghazaryan	Meudon, France	2 months	21.03-21.05
Arthur Nikoghossian	Kiev, Ukraine	3 weeks	22.03-11.04
Haik Harutyunian	Meudon, France	3 weeks	04.04-24.04
Edward Khachikian	Caltech, USA	1 month	05.04-05.05
Tigran Magakian	France	1 week	26.04-03.05
Elena Nikogossian	France	1 week	26.04-03.05
Areg Mickaelian	Paris, France	2 weeks	29.04-14.05
Areg Mickaelian	Geneva, Switzerland	1 week	03.05-06.05
Areg Mickaelian	Liege, Belgium	1 day	07.05
Lusine Sargsyan	Hamburg, Germany	3 weeks	12.05-03.06
Vardan Adibekyan	IAP, France	1 week	16.05-22.05
Artur Hakobyan	IAP, France	2 weeks	16.05-31.05
Artashes Petrosian	IAP, France	2 weeks	18.05-00.05
Artashes Petrosian	STScI, USA	3 months	00.05-01.09
Anahit Samsonyan	Vatican	1 month	30.05-08.07
Artur Hakobyan	IAP, France	1 week	25.06-05.07
Gurgen Paronyan	Pushchino, Russia	2 weeks	04.07-17.07
Lusine Sargsyan	Cornell Univ., USA	1 month	06.07-03.08
Arthur Nikoghossian	Russia	1 month	28.07-28.08
Areg Mickaelian	Lisbon, Portugal	1 week	05.09-10.09
Satenik Ghazaryan	Meudon, France	3 months	04.10-30.12
Marietta Gyulzadyan	Sudak, Crimea, Ukraine	2 weeks	16.10-25.10
Artashes Petrosian	IAP, France	2 weeks	18.10-30.11
Artur Hakobyan	IAP, France	1 month	31.10-30.11
Tigran Movsessian	Germany	1 week	13.11-20.11
Ararat Yeghikian	India	1 week	23.11-01.12

Visits of foreign scientists

Altogether 56 scientists from 22 countries visited Byurakan during 2010. Most visits were connected with the ISYA-2010 (16 lecturers and 32 students) and Viktor Ambartsumian International Prize award ceremony (6 more scientists). Most active were scientists from Germany (9), France (8), Russia (6), USA (5), Iran, Switzerland, and Spain, (3 each).

ISYA-2010 lecturers:

Georges Alecian (Observatoire Paris-Meudon (OBSPM), France), Sep-Oct, 2 weeks
Tigran Arshakian (Max-Planck-Inst. fur Radioastronomie, Bonn, Germany), Sep-Oct, 3 weeks
Gennady Bisnovaty-Kogan (Space Research Institute (IKI), Moscow, Russia), Sep, 1 week
Igor Chilingarian (Sternberg Astronomical Institute (SAI), Russia), Sep, 3 days
Jean-Pierre de Greve (Dept Physics – DNTK, Vrije Univ. Brussel, Belgium), Sep-Oct, 3 weeks
Michel Dennefeld (Institute d'Astrophysique de Paris (IAP), France), Sep, 1 week
Dieter Engels (Hamburger Sternwarte (HS), Germany), Sep-Oct, 10 days
Garik Israelian (Instituto de Astrofisica de Canarias (IAC), Spain), Sep-Oct, 3 weeks
Daniel Kunth (Institute d'Astrophysique de Paris (IAP), France), Sep-Oct, 2 weeks
Kam-Ching Leung (Behlen Observatory, University of Nebraska-Lincoln, USA), Sep-Oct, 3 weeks
Gary Mamon (Institute d'Astrophysique de Paris (IAP), France), Sep, 1 week
Mustapha Meftah (Versailles St. Quentin Univ., LATMOS, France), Sep, 1 week
Leslie Sage (Nature journal, Washington, DC, USA), Sep, 1 week
Alain Sarkissian (Versailles St. Quentin Univ., LATMOS, France), Sep, 1 week
Robert Williams (Space Telescope Science Institute (STScI), USA), Sep, 1 week
Lutz Wisotzki (Astrophysikalisches Institut Potsdam (AIP), Germany), Sep-Oct, 1 week

ISYA-2010 students (Sep – Oct, 3 weeks):

Maryam Anjiri (Ferdowsi University of Mashhad, Iran)
Magda Butkiewicz (Astronomical Observatory, Adam Mickiewicz University, Poland)
Diana Constantin (Astronomical Institute of the Romanian Academy, Romania)
Husne Dereli (Institute of Basic and Applied Sciences, Cukurova University, Turkey)
Sebastian Dietz (University of Regensburg, Germany)
Thomas Gauthier (Latmos, Université Versailles Saint Quentin (UVSQ), France)
Martin Gätgens (Universität Hamburg, Germany)
Lindita Hamolli (Department of Natural Sciences, University "Fan. S Noli", Korze, Albania)
Ganna Ivashchenko (Astron. Observatory of National Taras Shevchenko Univ., Kiev, Ukraine)
Davit Khutsishvili (Ilia State University, School of Graduate Studies, Astronomy, Georgia)
Evrin Kiran (Astronomy and Space Sciences Department, Ege University, Turkey)
Johannes Kleiner (University of Regensburg, Germany)
Fabian Köhlinger (Heidelberg University, Germany)
Natalia Lewandowska (Hamburger Sternwarte (HS), Germany)
Roxanne Ligi (Université Paris-Sud 11, France)
Rade Marjanovic (Faculty of Science, University of Novi Sad, Serbia)
Marius Maskoliunas (Institute of Theoretical Physics and Astronomy of Vilnius Univ., Lithuania)
Irakli Mghebrishvili (Ilia State University, School of Graduate Studies, Astronomy, Georgia)
Mahmoud Mohamed (Physics Department, Fayoum University, Egypt)
Ehsan Moravveji (Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, Iran)
Alexander Müller (Hamburger Sternwarte (HS), Germany)
Olga Nasonova (Special Astrophysical Observatory (SAO), Russia)
Alexandra Novikova (Dept of Astronomy, Faculty of Physics, Moscow State Univ. (MSU), Russia)

Athanasios Papageorgiou (Department of Physics, University of Patras, Greece)
Jana Polednikova (Dept Theor. Phys. & Astrophys., Faculty of Sci., Masaryk Univ., Czech Rep.)
Remigiusz Pospieszynski (Department of Physics, Umea University, Poland)
Agnieszka Rys (Instituto de Astrofísica de Canarias (IAC), Spain)
Evgeniya Shaldenkova (Sternberg Astron. Institute (SAI), Moscow State Univ. (MSU), Russia)
Hoda Shariati (Zanjan University, Iran)
Arun Kumar Singh (School of Studies in Phys. & Ap., Pt. Ravishankar Shukla U., Raipur, India)
Erika Verebelyi (Eotvos Lorand University, Budapest, Hungary)
Olga Zakhzhay (Main Astronomical Observatory, NAS of Ukraine, Kiev, Ukraine)

Viktor Ambartsumian International Prize award ceremony (Sep 2010, 1 week):

Gennady Bisnovaty-Kogan (Space Research Institute (IKI), Moscow, Russia)
Garik Israelian (Instituto de Astrofísica de Canarias (IAC), Spain)
Michel Mayor (Geneva Observatory, Switzerland)
Denis Monard (Swiss Academy of Sciences, Switzerland)
Leslie Sage (*Nature* journal, Washington, DC, USA)
Francisco Sanchez (Instituto de Astrofísica de Canarias (IAC), Spain)
Nuno Santos (Centro de Astrofísica da Universidade do Porto (CAUP), Portugal)
Yervant Terzian (Cornell University, Ithaca, NY, USA)
Stephane Udry (Geneva Observatory, Switzerland)
Robert Williams (Space Telescope Science Institute (STScI), USA)

Other guests:

Igor Karachentsev (SAO, Russia), October 2010, 1 week
Daniel Weedman (Cornell University, Ithaca, NY, USA), Oct-Nov 2010, 1 month

Participation in Meetings

During 2010, Byurakan astronomers have participated in 10 meetings, including JENAM-2010 in Lisbon, Portugal, as well as other meetings in France (2) and South Africa, summer schools in Switzerland, Vatican and Russia, the International Astronomical Olympiad in Ukraine, and 1 meeting and 1 summer school in Byurakan.

40th SAAS-Fee Course “Astrophysics at Very-High Energies”, 14-20 Mar 2010, Les Diablerets, Switzerland (S. Ghazaryan)

Communicating Astronomy with Public (CAP), 15-19 Mar 2010, Cape Town, South Africa (A.M. Mickaelian)

International Conference, 17-21 May 2010, IAP, Paris, France (V.Zh. Adibekyan, A.A. Hakobyan A.R. Petrosian)

12th Vatican Observatory Summer School on Observational Astronomy and Astrophysics “The Chemistry of the Universe”, 30 May – 25 June 2010, Vatican (A.L. Samsonyan)

XXVI IAP Annual Colloquium “Progenitors and Environments of Stellar Explosions”, 28 June – 2 July 2010, IAP, Paris, France (A.A. Hakobyan)

PRAO Radio Astronomy Summer School, 4-17 July 2010, Pushchino, Russia (G. Paronyan)

Joint European and National Astronomical Meeting 2010 (JENAM-2010), 6-10 Sep 2010, Lisbon, Portugal (A.M. Mickaelian)

Third Byurakan International Summer School / ISYA-2010, 12 Sep – 2 Oct 2010, Byurakan, Armenia (lecturers: A.M. Mickaelian, E.H. Nikogossian, L.A. Sargsyan; students from BAO: H. Abrahamyan, M. Gevorgyan, S. Ghazaryan, G. Paronyan, A. Samsonyan, D. Sargsyan, A. Zohrabyan)

15th International Astronomical Olympiad (IAO), 16-24 Oct 2010, Sudak, Crimea, Ukraine (M.V. Gyulzadian)

ArAS IX Annual Meeting, 26 Nov 2010, Byurakan, Armenia (BAO staff)

Talks and posters presented at meetings

During 2010, Byurakan astronomers presented oral and poster contributions at 4 meetings (in South Africa, France, Portugal, and in Byurakan) and gave 5 lectures at the Third Byurakan International Summer School (ISYA-2010).

Communicating Astronomy with Public (CAP) (oral contribution)

A.M. Mickaelian: *"IYA-2009 Armenian activities"*

XXVI IAP Annual Colloquium "Progenitors and Environments of Stellar Explosions"

A.A. Hakobyan, V.Zh. Adibekyan, A.R. Petrosian, L.S. Aramyan, G.A. Mamon, D. Kunth, M. Turatto: *"The SN host galaxies in SDSS DR7"*

JENAM-2010 (1 oral contribution and 2 posters)

Symposium 2: *Environment and the Formation of Galaxies: 30 years later:*

A.M. Mickaelian: "Study of the Byurakan-IRAS Galaxy pairs and the galaxy evolution" (poster)

Special Session 1: *Astronomy Challenges for Engineers & Computer Scientists:*

A.M. Mickaelian, L. Sargsyan, H. Astsatryan, A. Knyazyan: "ArVO web portal" (poster)

Special Session 6: *New Trends in Global Astronomy Education:*

A.M. Mickaelian: "Astronomy for Students DVD" (oral talk)

Third Byurakan International Summer School (5 lectures)

A.M. Mickaelian: *"Large Astronomical Surveys, Databases, and Archives"*

A.M. Mickaelian: *"Virtual Observatories"*

E.H. Nikogossian: *"Observational evidences of PMS stellar objects"*

L.A. Sargsyan: *"IR astronomy with the Spitzer Space Telescope (SST)"*

L.A. Sargsyan: *"IR astronomy with Herschel"*

ArAS IX Annual Meeting (report)

A.M. Mickaelian: *"ArAS annual report 2009-2010"*

Seminars

01.03, Byurakan

Areg Mickaelian: *"Extrasolar planets: methods of discovery and investigation"*

26.04, Byurakan

Parandzem Sinamyan: *"BAO plate archive"*

17.05, Byurakan

Gurgen Paronyan: *"Study of quasars and radiogalaxies containing compact radio sources"*

24.05, Byurakan

Kamo Gigoyan: *"Observations and research carried out in Italy"*

14.06, Byurakan

Lusine Sargsyan: *"IRAS-Spitzer-AKARI-HSO: advancement to far infrared"*

14.06, Byurakan

Areg Mickaelian: *"Active galaxies and statistics of their properties"*

28.06, Byurakan

Edward Khachikian: *"Main physical properties of active galaxies"*

06.07, Byurakan

Tigran Magakian: *"Results of submillimeter observations around "Braid" nebula"*

30.08, Byurakan

Areg Mickaelian: *"Photometry and variability of the FBS blue stellar objects"*

11.10, Byurakan

Dmitri Karachentsev: *"Cosmography of the Local Universe"*

18.10, Byurakan	Daniel Weedman: “When did the most luminous galaxies form?”
25.10, Byurakan	Haik Harutyunian: “Accelerating expansion of the Universe and Ambartsumian events”
01.11, Byurakan	Arthur Nikoghossian: “Turbulence”
08.11, Byurakan	Hovhannes Pikichian: “Internal radiation field of the layer of finite thickness in non-linear problem of transfer”
22.11, Byurakan	Ruben Andreassian: “Structure of the large-scale magnetic field of the Galaxy”
06.12, Byurakan	Abraham Mahtessian: “Luminosity function of the field galaxies”

On May 7, at Institut d'Astrophysique et de Geophysique, Liege, Belgium, **Areg Mickaelian** gave an invited seminar on “Active galaxies and statistics of their properties”.

Publications

During 2010, Byurakan astronomers published 26 papers in refereed journals, 16 in proceedings of meetings, 1 electronic catalog, and 6 other publications. A number of information materials and popular articles were published as well.

Refereed journal papers

E.Ye. Khachikian – Ambartsumyan’s concept of active galactic nuclei // *Astrophysics*, Vol. 53, No. 1, p. 1-17, Jan 2010.

H.A. Harutyunian, Monica Biernacka, Piotr Flin – An attempt to test Ambartsumian's idea of the origin of the galaxy. II. Location of galaxies within clusters and galaxy position angles // *Astrophysics*, Vol. 53, No. 1, p. 42-49, Jan 2010.

M.A. Kazarian, **V.Zh. Adibekyan**, B. McLean, R.J. Allen, **A.R. Petrosian** – A catalog of Kazarian galaxies // *Astrophysics*, Vol. 53, No. 1, p. 57-69, Jan 2010.

A.P. Mahtessian, V.G. Movsessian – List of groups of galaxies based on the CfA2 redshift survey // *Astrophysics*, Vol. 53, No. 1, p. 70-81, Jan 2010.

A.L. Gyulbudaghian – Relationship of groups of submillimeter starless condensations to radial systems of dark globules // *Astrophysics*, Vol. 53, No. 1, p. 112-122, Jan 2010.

K.S. Gigoyan, P.K. Sinamyan, D. Engels, **A.M. Mickaelian** – Late-type stars found in the DFBS // *Astrophysics*, Vol. 53, No. 1, p. 123-132, Jan 2010.

Magakian T.Yu., Nikoghossian E.H., Aspin C., Pyo T.-S., Khanzadyan T., **Movsessian T.**, Smith M.D., Mitchison S., Davis C.J., Beck T.L., Moriarty-Schieven G.H. – A Wide-Field Narrowband Optical Survey of the Braid Nebula Star Formation Region in Cygnus OB7 // *Astronomical Journal*, Vol. 139, No. 3, p. 969-983, Mar 2010.

A.P. Mahtessian, V.H. Movsessian – High surface brightness Arakelian galaxies and their environment // *Astrophysics*, Vol. 53, No. 2, p. 163-173, Apr 2010.

N.D. Melikian, V.S. Tamazian, J.A. Docobo, **A.A. Karapetian, G.R. Kostandian, A.L. Samsonyan** – Spectral observations of the eclipsing binary RY Sct // *Astrophysics*, Vol. 53, No. 2, p. 202-211, Apr 2010.

H.V. Pikichian – Nonlinear diffuse reflection and transmission of radiative energy by a layer of finite thickness // *Astrophysics*, Vol. 53, No. 2, p. 251-267, Apr 2010.

K.S. Gigoyan, T.A. Movsessian, V.V. Hambaryan – ROSAT source 1RXS J181333.7+453118, a Seyfert galaxy // *Astrophysics*, Vol. 53, No. 2, p. 302-305, Apr 2010.

Ter-Kazarian G. – Gravitation and inertia; a rearrangement of vacuum in gravity // *Astrophysics and Space Science*, Vol. 327, No. 1, p. 91-109, May 2010.

Rossi C., Gaudenzi S., Frasca A., Spezzi L., Nesci R., Sclavi S., Magazzu A., **Mickaelian A.**, **Gigoyan K.** – IRAS F18187+6304: a puzzling emission line star // *Memorie della Societa Astronomica Italiana Supplement*, Vol. 14, p. 127, 2010.

Sargsyan L.A., Weedman D.W., Houck J.R. – Comparing Ultraviolet- and Infrared-selected Starburst Galaxies in Dust Obscuration and Luminosity // *Astrophysical Journal*, Vol. 715, No. 2, p. 986-1005, June 2010.

H.A. Harutyunian – On a possible source of energy for the ejection of matter from cosmic objects // *Astrophysics*, Vol. 53, No. 3, p. 311-319, July 2010.

R.A. Kandalyan, M.M. Al-Zyout – Extragalactic H₂O maser sources and their properties // *Astrophysics*, Vol. 53, No. 3, p. 329-341, July 2010.

N.D. Melikian, V.S. Tamazian, J.A. Docobo, **A.A. Karapetian**, **G.R. Kostandian**, A.A. Henden – Spectral and photometric observations of TT Ari. III. // *Astrophysics*, Vol. 53, No. 3, p. 373-386, July 2010.

A.G. Nikoghossian, Z. Mouradian – On determining the microturbulent velocities of Solar prominences // *Astrophysics*, Vol. 53, No. 3, p. 387-395, July 2010.

Mickaelian A.M., **Sinamyanyan P.K.** – Proper motions and natures of First Byurakan Survey blue stellar objects // *Monthly Notices of the Royal Astronomical Society*, Vol. 407, No. 1, p. 681-690, Sep 2010.

Docobo J.A., Tamazian V.S., Balega Y.Y., **Melikian N.D.** – E MCCD Speckle Interferometry with the 6m Telescope: Astrometric Measurements, Differential Photometry, and Orbits // *Astronomical Journal*, Vol. 140, No. 4, p. 1078-1083, Oct 2010.

R.A. Kandalyan, M.M. Al-Zyout – Circumnuclear dense gas in OH-megamaser galaxies // *Astrophysics*, Vol. 53, No. 4, p. 475-482, Dec 2010.

A.M. Mickaelian, **L.A. Sargsyan** – Spectral observations of BIG objects // *Astrophysics*, Vol. 53, No. 4, p. 483-489, Dec 2010.

N.D. Melikian, **A.A. Karapetian** – New H α stars. Cyg OB7 region. I. // *Astrophysics*, Vol. 53, No. 4, p. 490-496, Dec 2010.

A.L. Gyulbudaghian, J. May – Southern YSO GRV10 and its environment // *Astrophysics*, Vol. 53, No. 4, p. 503-510, Dec 2010.

A.A. Akopian – Cyclic flaring activity of flare stars // *Astrophysics*, Vol. 53, No. 4, p. 544-553, Dec 2010.

A.P. Mahtessian, **V.H. Movsessian** – Morphology of Markarian galaxies in single galaxies and groups // *Astrophysics*, Vol. 53, No. 4, p. 570-572, Dec 2010.

Proceedings papers

Coronal Fine Linear Rays: Are They Fast Streams From Active Regions?

Koutchmy S., Lamy P., Viladrich C., Filippov B., **Nikoghossian A.**, Golub L.

// *Twelfth International Solar Wind Conference. AIP Conf. Proc.*, Vol. 1216, p. 339-342, Mar 2010.

Byurakan-IRAS Galaxy Pairs as Indicators of Starburst and Galaxy Evolution

Mickaelian A.M., **Sargsyan L.A.**, Mikayelyan G.A.

// *Co-Evolution of Central Black Holes and Galaxies, Proc. IAU Symp.*, Vol. 267, p. 124, May 2010.

Local Lyman α Emitters and Their Relevance to High Redshift Ones

Kunth D., Atek H., Ostlin G., Hayes M., Mas-Hesse M., Leitherer C., **Petrosian A.**, Schaerer D.

// *The Impact of HST on European Astronomy, Astrophysics and Space Science Proceedings, Springer Science+Business Media B.V.*, p. 203, 2010.

Papers in Evolution of Cosmic Objects through their Physical Activity, Proc. Conf. dedicated to Viktor Ambartsumian's 100th anniversary, held 15-18 Sep 2008 in Yerevan and Byurakan, Armenia, Eds.: H.A. Harutyunian, A.M. Mickaelian & Y. Terzian, Yerevan, "Gitutyun" Publishing House of NAS RA, Nov 2010:

Magakian, T.Yu.; Movsessian, T.H.; Nikogossian, E.H.; Khanzadyan, T.; **Hovhannesian, E.R.; Sargsyan, D.M.** – Multi-Sided Studies of the Manifestations of Young Stellar Activity in Star Forming Regions // p. 39-54.

Gyulbudaghian, A.L. – OB-Associations and Molecular Clouds // p. 62-69.

Yeghikyan, A.G. – On cosmic ray processing of ices in molecular clouds // p. 70-76.

Hovhannisyan, L.R.; Weedman, D.; **Mickaelian, A.M.;** Le Floch, E.; Houck, J.R.; Dey, A.; Jannuzi, B.; Brand, K.; Soifer, B.T. – Bright Stars with Spitzer 24 μ m Excesses in Boötes and FLS // p. 84-90.

Ohanesyan, J.B. – Identification of Peculiar A-Stars. Analysis of the Equivalent Widths of the 2786-2810 Å Spectral Bands and the MgII 4481 Å Line for 137 A-Stars // p. 91-96.

Harutyunian, H.A.; Mickaelian, A.M. – V.A. Ambartsumian and the Activity of Galactic Nuclei // p. 134-151.

Biernacka, M.; Flin, P.; **Harutyunian, H.A.** – Testing the Possibility of Galaxy Ejection // p. 182-187.

Andreasyan, R.R. – On the formation and evolution of extended extragalactic radio sources. Implications for the Fanaroff-Riley Dichotomy // p. 207-213.

Amirkhanian, A.S.; Egikian, A.G.; Del Olmo, A.; Perea, J. – A comprehensive study of Shahbazian compact groups of galaxies // p. 225-227.

Sargsyan, L.A.; Mickaelian, A.M.; Weedman, D.W.; Houck, J.R. – Infrared and Optical Study of Faint IRAS-FSC Sources // p. 231-237.

Gyulzadian, M.V.; Petrosian, A.R.; Mclean, B. – Relationship of Galaxies from the Second Byurakan Survey to Zwicky Clusters // p. 238-240.

Nikoghossian, A.G. – Ambartsumian's Methods in the Radiative Transfer Theory // p. 276-295.

Pikichian, H.V. – New opportunities in non-linear radiative transfer based on Ambartsumian's Principle of Invariance // p. 302-315.

Electronic catalogs

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. – FSS galaxies in southern hemisphere // *VizieR On-line Data Catalog: J/other/Ap/52.40. Originally published in: 2009Ap.....52...40H, July 2010.*

Other papers

Andreasyan R., Balayan S., Movsisyan V. – Magnetic Field Structure near the Galactic Plane // *eprint arXiv:1012.0646, 12/2010.*

Harutyunian, H.A.; Mickaelian, A.M.; Terzian, Y. (Editors) – Evolution of Cosmic Objects through their Physical Activity, Proceedings of the Conference dedicated to Viktor Ambartsumian's 100th anniversary // Yerevan, "Gitutyun" Publishing House of the National Academy of Sciences of the Republic of Armenia (NAS RA), 355 p., Nov 2010.

Abstracts in Evolution of Cosmic Objects through their Physical Activity, Proc. Conf. dedicated to Viktor Ambartsumian's 100th anniversary, held 15-18 Sep 2008 in Yerevan and Byurakan, Armenia, Eds.: H.A. Harutyunian, A.M. Mickaelian & Y. Terzian, Yerevan, "Gitutyun" Publishing House of NAS RA, Nov 2010:

Asatrian, N.S. – Investigation of rapid profile variability in the broad hydrogen lines of AGNs // p. 206.

Yeghiazaryan, A.A. – Three Pairs of Galaxies with Ultraviolet Excess // p. 241.

Kandalyan, R.A. – X-ray Properties of OH Megamaser Galaxies // p. 241.

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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 2010, 4 papers were published in AJ, ApJ, A&A, and MNRAS, including 2 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. Hovhannisyan, 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. Sinamyian, A.A. Sinanian.

Teaching, supervision of students

Following Byurakan scientists teach astrophysical subjects at the YSU Department of Physics, Chair of General Physics and Astrophysics: V.Zh. Adibekyan, A.A. Akopian, A.A. Hakobyan, H.A. Harutyunian, T.Yu. Magakian, V.H. Malumian, A.M. Mickaelian, T.H. Movsessian, A.G. Nikoghossian, A.G. Yeghikyan. **Prof. Davit Sedrakian** is the head of the Chair of General Physics and Astrophysics.

Byurakan scientists have also been supervisors of B.Sc. and M.Sc. Diploma theses at the YSU. 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. Sinamyian. One Ph.D. thesis was defended at BAO Special Council on January 18 2010: **L.A. Sargsyan** (supervisors: A.M. Mickaelian and D. Weedman).

The International Astronomical Olympiad was held in 2010 in Ukraine, where three Armenian pupils won Third-rank Diploma (teacher: Marietta Gyulzadian).

Membership

International Astronomical Union (IAU, 16 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, R.K. Shahbazian (retired).

European Astronomical Society (EAS, 18 members): A.S. Amirkhanian, R.R. Andriasyan, K.S. Gigoyan, A.A. Hakobyan, H.A. Harutyunian, M.A. Hovhannissian, S.G. Iskudarian, E.Ye. Khachikian, T.Yu. Magakian, V.H. Malumian, N.D. Melikian, A.M. Mickaelian, T.H. Movsessian, E.H. 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): 41 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 2010 with 57 papers, including 20 from BAO.

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** (recently substituted by **P.K. Sinamyan**), Webmaster: **G.A. Mikayelyan**. ArAS has 90 members. During 2010, the ArAS webpage was updated, eight issues of the Newsletter (ArASNews) were released, ArAS IX meeting was held on November 26, ArAS Annual prize for Young Astronomers was awarded to Parandzem Sinamyan, 6 new ArAS members were accepted.