

SCIENCE IN BYURAKAN IN 2000-2008

After the very hard years in 1990s, the Byurakan Astrophysical Observatory gradually enters a new epoch of its development and activities. The situation of the recent years have controversial influence on science in Byurakan; from one hand the funding remains at very low level and it is rather difficult to attract young people (though there are a lot of good ones), and on the other hand, possibilities for international collaboration and joint high-level research are now open. The infrastructure in Byurakan needs a lot of funding; especially the telescopes are in poor state (renovation, new equipment, and new receivers are needed), however, the Byurakan astronomers now use also foreign instruments, including space telescopes (HST, SST, etc.) and publish papers in prestigious international journals (ApJ, AJ, A&A, etc.), which before was extremely rare. One of the important changes is the possibility of doing high-level science using the Internet resources (as well as using the Virtual Observatory (VO) environment; the Armenian VO project was recently started), which significantly helps countries like Armenia where there are good scientists but no enough funding and conditions. At last, a number of grants and short-term foreign fellowships are available that give an important financial support for actively working astronomers.

One could state that during all the recent years (the years of independence in Armenia?), no detailed analysis of the situation in science in Byurakan has been made, and this will be an attempt to present the objective situation and find ways for further efficient developments. It is especially important because the science funding is now directed at the national and international programs and large projects. So based on the analysis of the efficiency of the past years, Armenian astronomy should define its science policy and develop the national program for the next decades (like the **Decadal Programs** in the USA and **ASTRONET** in Europe). And besides, one of the ways to survive is joining the large international programs and projects. This should be a state policy; however until now anything achieved has been done by individual scientists or research groups.

Compared to the Soviet times (and even to 1990s), at present the **research staff of BAO** is not very large; 51 researchers. Since 2003, **Dr. H.A. Harutyunian** is the Director, **Dr. N.D. Melikian** is the Deputy Director, and **Dr. E.H. Nikogossian** is the Scientific Secretary. *Dr. A.M. Mickaelian* is in charge of the international relations. There is a Scientific Council chaired by the Director that discusses current problems and is advisory for the administration. The scientific departments at present do not operate, though in fact (as before) the research staff is divided into three large sections: Physics of Stars and Nebulae, Extragalactic Astronomy, and Theoretical Astrophysics. There are **three laboratories for technical developments**; the Laboratory of 2.6m telescope (headed by T.H. Movsessian), the Laboratory of 1m Schmidt telescope (headed by S.K. Balayan), and the Laboratory of Small telescopes (headed by A.S. Amirkhanian). The research staff of BAO is rather old; the average age is 51.6 year. There are only 7 astronomers younger than 30 (1 is a Ph.D. student, and 4 are still students and work part-time), 6 are between 30 and 40, 4 – between 40 and 50, 19 – between 50 and 60, 6 – between 60 and 70, and 9 are between 70 and 80. This pattern appeared due to a long absence of young scientists in 1990s, and now the situation is being gradually improved. There are 27 Ph.D.s (43-77 years old, average age is 58!) and 6 Doctors of Science (D.Sci.) (55-80 years old, average age is 69.5).

The **2.6m telescope** is in fact the only instrument that gives scientific results. The famous **1m Schmidt telescope** is under renovation and a project in collaboration with Russian colleagues is active. However, it is not yet clear when the scientific results will come. A few other **small telescopes** are in use as well and may be used for study of Solar system bodies, variable stars, bright galaxies, etc. The **Byurakan plate archive** is very rich (some 30,000 plates), and there are plans for digitization and creation of an electronic database for further possible projects. The famous First Byurakan Survey (FBS, Markarian survey) has been digitized and now is available as the Digitized FBS (**DFBS**). A part of the Second Byurakan Survey (SBS) has been also scanned and upon collection of the missing plates will be fully digitized. Leaving the description of telescopes and databases for another article, I would like here to focus on the research projects, obtained results, publications, international collaboration, and grants, as well as other topics and events in the Byurakan's science will be discussed.

To have full information about science in Byurakan, for the first time a complete analysis of all activities in 2000-2008 has been carried out and as a result we have created and published a database of current science projects, international collaboration, received grants, obtained scientific results and achievements, and publications by the Byurakan astronomers during 2000-2008, as well as the scientific meetings and other activities. This database is available at the ArAS webpage under the menu *Byurakan Astrophysical Observatory* (see also the section “ArAS new webpage” of this Newsletter, p. 18).

Current Projects is a complete reference, where one can find submenus to view the projects by subjects, by principal investigators (PI), by collaborating countries, by received grants, or by number of publications. You are able to view, for example, projects that are devoted to studies of non-stable stars or AGN (as well as by sub-subjects in these fields), projects that are led by T.Yu. Magakian or A.R. Petrosian, projects that are being developed in collaboration with French or US astronomers, or those projects that have been awarded ANSEF or PICS (travel) grants. It is amazing that even at this difficult time for BAO our astronomers maintain several dozens of projects, many of which have international collaboration and have awarded grants from various science funds. But what is their productivity? We will see later.

For each project, title, main topics, the team, collaborations, number of publications in 2000-2008 (and link to the publications), grants, and contact person (typically the PI) are given. Altogether, Byurakan astronomers have 97 large and small projects, which are divided to the following general subjects: Sun and Solar System (4 projects), Physics of Stars and Nebulae (33), Extragalactic Astronomy (39), Surveys (3), Multiwavelength Astronomy (6), Cosmology and Theoretical Astrophysics (5), Databases (3), and Instrumentation (4). 33 PIs lead these projects, in some cases the PI is conditional as the PI is a foreign scientist for some collaborative projects or some astronomers develop a project without funding and without having an official project.

Let us present a few of the **largest projects** having many publications, collaborations, and grants:

Spectroscopic Study of Young Stellar Objects (T.Yu. Magakian (PI), T.H. Movsessian, E.H. Nikogossian, et al.). Collaboration with France, Germany, Japan, Russia, UK, and USA. ANSEF, two INTAS, and NFSAT research grants, PICS and DAAD travel grants. 15 publications in 2000-2008.

The FBS Late-Type Stars (K.S. Gigoyan (PI), et al.). Collaboration with France, Germany, and UK. PICS and DAAD travel grants. 15 publications.

The FBS Blue Stellar Objects (A.M. Mickaelian (PI), P.K. Sinamyan). Collaboration with France and Italy. PICS and Roma University travel grants. 14 publications.

Radiative Transfer in Inhomogeneous Atmospheres (A.G. Nikoghossian). Collaboration with France. PICS travel grants. 12 publications.

Optical Identification and Study of IRAS Sources (A.M. Mickaelian (PI), K.S. Gigoyan, L.A. Sargsyan). 12 publications.

Spectroscopic Study of BIG Objects (A.M. Mickaelian (PI), S.A. Hakopian, S.K. Balayan, L.A. Sargsyan). Collaboration with France and Russia. ANSEF research grant and PICS travel grants. 11 publications.

The Digitized First Byurakan Survey (DFBS) (A.M. Mickaelian (PI), L.A. Sargsyan, et al.). Collaboration with Italy, USA, Germany, and IIAP (Armenia). ANSEF and CRDF research grants, PICS, NSF/NASA, and Rome University travel grants. 10 publications.

Search and Study of Carbon Stars in the Galactic Halo (K.S. Gigoyan (PI), et al.). Collaboration with France, Germany, Italy, and UK. PICS and DAAD travel grants. 10 publications.

Studies of Local Starburst Galaxies (A.R. Petrosian (PI), et al.). Collaboration with France and USA. STScI fellowships and PICS travel grants. 10 publications.

The Formation of Heavy Molecules in Molecular Clouds and Related Phenomena (A.G. Yeghikyan). Collaboration with Germany, Italy, and UK. 9 publications.

Observations of Flare Stars in Solar Neighbourhood and New Flare Stars in Galactic Dark Clouds (N.D. Melikian (PI), A.A. Karapetian). Collaboration with Australia, France, Georgia, Russia, and Spain. PICS travel grants. 8 publications.

Search for HH-Objects and Emission-Line Stars in Star Forming Regions (T.Yu. Magakian (PI), T.H. Movsessian, E.H. Nikogossian). Collaboration with USA. ANSEF grant. 7 publications.

Studies of the SBS Galaxies (A.R. Petrosian (PI), et al.). Collaboration with USA. STScI fellowships. 7 publications.

Spectral Study of the SBS Galaxies in the Selected Fields (S.A. Hakopian (PI), S.K. Balayan). Collaboration with Russia. ANSEF grant. 7 publications.

Spectral, Photometric, and Speckle Studies of Visual Binaries (N.D. Melikian (PI), A.A. Karapetian). Collaboration with Mexico, Russia, and Spain. 6 publications.

Supernovae in Active and Star Forming Galaxies (A.R. Petrosian (PI), A.A. Hakobyan). Collaboration with France, Italy, and USA. STScI fellowships and PICS travel grants. 6 publications.

Radiation of Coronal Supra-Thermal Steams (A.G. Nikoghossian). Collaboration with France. PICS travel grants. 5 publications.

Detailed Study of the T Tau Star AA Tau and New T Tau Stars (T.Yu. Magakian (PI), T.H. Movsessian, E.H. Nikogossian). Collaboration with France, Japan, and Kazakhstan. 5 publications.

Galactic Molecular Clouds and Star Forming Regions (A.L. Gyulbudaghian). Collaboration with Chile. 5 publications.

Statistical Studies of Radio Pulsars (V.H. Malumian (PI), A.N. Harutyunyan). 5 publications.

Search and Study of Dark Globules (A.L. Gyulbudaghian). Collaboration with Chile. 4 publications.

It is necessary to note that very few projects are being supported by the Armenian government (in fact at very low funding level). At present there are only **6 projects having state (thematic) funding**; these are groups headed by E.Ye. Khachikian, T.Yu. Magakian, A.P. Mahtessian, A.G. Nikoghossian, E.S. Parsamian, and A.R. Petrosian. In addition, N.D. Melikian and A.M. Mickaelian have their research groups.

But I would like to focus on the real research groups and their efficiency. In fact, there are very few people in Byurakan working together and having joint publications. The best (the only?) example is T.Yu. Magakian's group, namely T.Yu. Magakian, T.H. Movsessian and E.H. Nikogossian; they started working together in 2003 and since then have 13 joint publications (10 refereed ones), which is the maximum in Byurakan. There are no other groups (three or more people) having even 5 refereed publications! The next one was the group of A.M. Mickaelian, S.A. Hakopian and S.K. Balayan working together in 2000-2004 which produced 8 publications (but only 4 refereed). If taking pairs of researchers, T.Yu. Magakian and T.H. Movsessian have 27 joint publications (20 refereed) (including also those with E.H. Nikogossian), N.D. Melikian and A.A. Karapetian – 18 (15), S.A. Hakopian and S.K. Balayan – 15 (10) (including those with A.M. Mickaelian), A.M. Mickaelian and K.S. Gigoyan – 12 (7), K.S. Gigoyan and H.V. Abrahamian – 12 (7), A.M. Mickaelian and L.A. Sargsyan – 11 (7), and A.M. Mickaelian and S.K. Balayan – 11 (5) (including those with S.A. Hakopian). In addition, some of these pairs published papers on different subjects and no definite project can be mentioned. This is the situation, which is not typical of the situation in modern science, where most of the strong projects have stable teams working together for some period and producing dozens of papers. It may be stated that this way large projects are not possible in Byurakan, which is really so; this is one of the main problems and the reason for so many (small) projects and numerous subjects. The research staff of 51 persons have 97 projects, but only 10 of them produced 9 or more publications during 2000-2008, i. e. at least one paper per year! If we take only refereed papers, then the situation is even worse.

May be then (some of) the Byurakan scientists prefer working alone? If taking papers by single authors (individually working researchers), the situation is completely different. It appears that most of the productive authors have 1-2 or even no individual papers. If taking only refereed papers, most productive have been A.M. Mickaelian (11), A.G. Nikoghossian (10), L.K. Erastova (5), and H.A. Harutyunian (4).

Let us combine the projects to have larger ones and list those having at least 10 publications in 2000-2008; we will have only the following 8 projects (it's better to say 'research fields'):

Search and studies of young stellar objects (T.Yu. Magakian, et al.), 33 publications (23 refereed).

Studies of AGN, starbursts, and Supernovae (A.R. Petrosian, et al.), 30 (22).

Late-type (including carbon) stars (K.S. Gigoyan, et al.), 25 (18).

Optical identification and studies of IR sources (A.M. Mickaelian, et al.), 27 (17).

FBS blue stellar objects, DFBS, and ArVO (A.M. Mickaelian, et al.), 28 (15).

Study of star formation regions and late-type stars (N.D. Melikian, et al.), 18 (15).

Radiative transfer in inhomogeneous atmospheres (A.G. Nikoghossian), 12 (12).
Galactic star forming regions and dark globules (A.L. Gyulbudaghian), 11 (11).

We must note that the DFBS is in fact a large project, which itself produced only 10 publications because of its scientific-technical nature, and the main result came after several years of hard work (many papers are expected from science projects based on the DFBS). Some of other projects also promise a good number of publications in the nearest future.

In frame of these projects, a number of **important results** have been obtained in 2000-2008, namely:

Observational discoveries:

- 2000-2001**, Discovery of new bright QSOs in the FBS and estimation of their surface density (0.012 deg⁻² for objects with $B < 16.1$) (**A.M. Mickaelian**, in collaboration with astronomers from France).
- 2000-2004**, Discovery of new Seyferts, LINERs, and starbursts among the SBS galaxies (**S.A. Hakopian, S.K. Balayan**, in collaboration with astronomers from SAO, Russia).
- 2000-2004**, Optical identifications and studies of 1577 IRAS infrared sources; discovery of new AGN and ULIRGs (**A.M. Mickaelian, K.S. Gigoyan, L.A. Sargsyan**).
- 2000-2008**, Detailed studies of young stellar objects: discovery of new jets (**T.Yu. Magakian, T.H. Movsessian, E.H. Nikogossian, E.R. Hovhannessian**, in collaboration with astronomers from Russia, USA, and UK).
- 2000-2006**, Discovery of new dark globules in the star forming regions and rotation of some of them (**A.L. Gyulbudaghian**, in collaboration with astronomers from Spain and Chile).
- 2001**, Discovery of gas-dust shells around 34 early type stars with IR excess (**R.Kh. Hovhannessian, E.R. Hovhannessian**).
- 2001-2008**, Discovery of new flare stars in Galactic Dark Clouds (**N.D. Melikian, A.A. Karapetian**, in collaboration with J.A. Docobo and V.S. Tamazian, Spain).
- 2002-2004**, Optical identifications and studies of ROSAT X-ray sources; discovery of 42 new AGN (**A.M. Mickaelian, S.K. Balayan, et al.**, in collaboration with D. Engels, et al., Hamburger Sternwarte, Germany).
- 2002-2008**, Many-sided studies of Local Starburst Galaxies (**A.R. Petrosian**, in collaboration with Space Telescope Science Institute, USA).
- 2003-2008**, Search for Herbig-Haro objects and emission-line stars in star formation regions; discovery of several dozens of new HH objects and emission stars (**T.Yu. Magakian, T.H. Movsessian, E.H. Nikogossian**).
- 2004-2007**, New survey of cool carbon stars in the halo based on 2MASS. Discovery of very red and distant objects (**K.S. Gigoyan**, in collaboration with astronomers from France and UK).
- 2004-2008**, Discovery of new white dwarfs, hot subdwarfs, cataclysmic variables, and planetary nebula among the FBS blue stellar objects (**A.M. Mickaelian, P.K. Sinamyan**).
- 2004-2008**, Studies of the Southern Galactic molecular clouds and star forming regions. Discovery of new Herbig-Haro objects and outflows (**A.L. Gyulbudaghian**, in collaboration with J. May, et al., Chile).
- 2007**, Discovery of 28 highest IR/optical flux ratio extragalactic objects (**A.M. Mickaelian, L.A. Sargsyan**, in collaboration with D.W. Weedman and J.R. Houck, Cornell University, USA).

Theoretical and statistical results:

- 2000-2001**, Determination of the radio luminosities of pulsars and the distribution of interstellar electron density (**R.R. Andreasyan, T.G. Arshakian**).
- 2000-2002**, Study of the magnetic fields of extragalactic radio sources; mechanism of formation of a dipole magnetic field, etc. (**R.R. Andreasyan**, in collaboration with astronomers from France).
- 2001-2002**, Interpretation of the radiation of the coronal supra-thermal streams by the effect of Compton scattering of the photospheric radiation on fast electrons (**A.G. Nikoghossian**, in collaboration with S. Koutchmy, France).
- 2001-2008**, Statistical studies of Supernovae in active and star forming galaxies (**A.R. Petrosian, et al.**, in collaboration with astronomers from France, Italy, and USA).

- 2001-2008**, Derivation of the frequency distribution function of stellar flares (**A.A. Akopian**).
- 2003**, Obtaining accurate BVIJHK period-luminosity relations for classical Cepheids in the Galaxy and Magellanic clouds (**H.V. Abrahamian**).
- 2003-2008**, Suggestion that cD galaxies are generators of the clusters in which they occur (**H.A. Harutyunian**).
- 2004**, A new approach was proposed for solution of the simplest one-dimensional problem of diffuse reflection and transmission of radiation in inhomogeneous atmospheres (**A.G. Nikoghossian**).
- 2004**, The hypothesis of possible anomalous redshift in spectra of young objects based on counts of faint blue objects (**H.A. Harutyunian**).
- 2005-2007**, Study of the structure and substructures of Coma cluster of galaxies (**A.T. Kalloghlian**, in collaboration with **N.G. Kogoshvili** and **T.M. Borchkhadze**, Georgia).

Publication of catalogs, databases, and atlases:

- 2003**, Merged catalogue of reflection nebulae (**T.Yu. Magakian**).
- 2004**, Catalog of 216 stars with probable circular polarization (**M.H. Eritsian**).
- 2005**, The Byurakan/Hamburg/ROSAT Catalogue (BHRC) (**A.M. Mickaelian**, **L.R. Hovhannisyan**, in collaboration with **D. Engels**, et al., *Hamburger Sternwarte, Germany*).
- 2006**, Revised and updated catalog of 276 Byurakan-IRAS Stars (BIS) (**A.M. Mickaelian**, **K.S. Gigoyan**).
- 2007**, Digitized First Byurakan Survey (DFBS) database (**A.M. Mickaelian**, **L.A. Sargsyan**, et al., in collaboration with "La Sapienza" *Universita di Roma, Italy* and *Cornell University, USA*).
- 2007**, Optical Database and Atlas of Markarian galaxies (**A.R. Petrosian**, in collaboration with *Space Telescope Science Institute, USA*).
- 2007**, Catalog of the FBS late-type stars (**H.V. Abrahamian**).
- 2008**, Revised and updated catalog of 1103 FBS blue stellar objects (**A.M. Mickaelian**).

Altogether during 2000-2008, according to the ADS database the Byurakan astronomers have **400 publications** (265 refereed papers, 66 in proceedings of meetings, 24 electronic catalogs, 8 books, etc.). A full database has been compiled and is available at ArAS webpage, where one can view the publications by year (2000, ..., 2008), by subject, by author, by type (refereed journals, proceedings, electronic catalogs, books, e-prints, etc.), or by journal. The distribution of publications by years is the following: **2000** – 38 (29 refereed), **2001** – 46 (31), **2002** – 50 (30), **2003** – 40 (27), **2004** – 53 (40), **2005** – 40 (24), **2006** – 46 (27), **2007** – 38 (25), and **2008** – 49 (32). Thus the year 2004 was the most productive both for the total number and refereed publications, and 2008 is the second one, hence hopefully there may be a further progress.

If taking the **publications by subjects**, most of them relate to radiogalaxies (36), other active galactic nuclei (AGN; 35), young stellar objects (YSOs; 31), flare and T Tau stars (24), groups and clusters of galaxies (19), FBS late-type stars (18), theoretical astrophysics (18), FBS blue stellar objects (16), IR galaxies (16), IR sources (16), starburst galaxies (15), SBS galaxies (14), nebulae (13), Markarian galaxies (12), DFBS and ArVO (12), general studies of galaxies (11), carbon stars (10), and interstellar medium (10). All these are traditional Byurakan subjects, however some new directions are now active, like studies of IR, radio, and X-ray sources.

The **265 refereed papers** have been published in 21 journals: 6 are in *Astrophys. J. (ApJ)*, 10 in *Astron. J. (AJ)*, 45 in *Astron. Astrophys. (A&A)*, 6 in *Monthly Notices of RAS (MNRAS)*, 5 in *Astrophys. Space Sci. (ApSS)*, 1 in *PASP*, 1 in *Astron. Nachrichten (AN)*, 163 in *Astrophysics (Acmoφuzuka)*, 2 in *Astronomy Reports (AJ)*, 1 in *Astronomy Letters (ΠAJ)*, 6 in *Astron. Astrophys. Transactions*, 5 in *Baltic Astronomy*, 3 in *Rev. Mex. Astron. Astrofis.*, 5 in *IBVS*, 2 in *Bulletin of SAO*, and 4 in other journals (*PASJ*, *ChJAA*, *RomAJ*, *AnnGPh*). Most of all refereed publications have **A.M. Mickaelian** (37), **T.H. Movsessian** (29), **K.S. Gigoyan** (25), **T.Yu. Magakian** (23), **A.R. Petrosian** (22), **N.D. Melikian** (21), **A.A. Karapetian** (16), **A.G. Nikoghossian** (16), **E.H. Nikogossian** (16), and **S.K. Balayan** (15). Among the young researchers, **L.A. Sargsyan** is the most productive (12 refereed papers). 67 papers have been published in the most important international journals (*ApJ*, *AJ*, *A&A*, and *MNRAS*), which is of course a very small number for 9 years for our whole staff. These publications are supported by the **Isaac Newton Institute (INI)** in Chile (President: *Prof. Goncalo Alcaino*); an Armenian branch of INI has been created in 2000 based on BAO, and authors

who publish papers in the mentioned four journals get bonuses. However, in fact only 25 Byurakan astronomers have published in these journals; most productive are A.R. Petrosian (17 papers), T.Yu. Magakian (10), K.S. Gigoyan (8), A.M. Mickaelian (8), T.H. Movsessian (8), and N.D. Melikian (6).

As it is obvious, most of the papers are in our ***Astrophysics***, which before was considered as an All-Union (Soviet) journal and now is considered as international one. However, we still have to do a lot to increase its rating. Anyway, publications in *Astrofizika* also give bonuses from the *Springer* publishing company, which organizes the translation, publication, and distribution of the *Astrophysics* (the English version) abroad. The **Editorial board of *Astrofizika*** consists of D.M. Sedrakian (*Editor-in-Chief*), V.V. Ivanov (Russia) and E.Ye. Khachikian (*Deputy Editors-in-Chief*), A.T. Kaloghlian (*Secretary-in-Chief*), G.S. Bisnovaty-Kogan (Russia), A.A. Boyarchuk (Russia), A.M. Cherepashchuk (Russia), Yu.N. Gnedin (Russia), V.P. Grinin (Russia), I.D. Karachentsev (Russia), D. Kunth (France), A.G. Nikoghossian, E.S. Parsamian, G.N. Salukvadze (Georgia), and Ye. Terzian (USA).

The **66 papers in proceedings of 41 meetings** have been published, including 27 IAU symposia and colloquia (however, 16 are in IAU Col. #184, held in 2001 in Byurakan). In addition, **14 abstracts** are listed in ADS, which have been published only in abstract books (others that later appeared in proceedings were removed). Out of **24 electronic catalogs** in *VizieR*, 7 are individual catalogs (having official numbers, these are in fact those listed above as important publications) and others are tables from published papers. To be complete, other Byurakan publications are **17 e-prints** (in *astro-ph* and elsewhere), **8 books and booklets** (including textbooks), and **6 information materials**.

As mentioned, for the present situation (and perhaps always) an active **international collaboration** is very crucial. There are some 100 scientists from 21 countries that collaborate with Byurakan astronomers. Most of the collaborations are with France, USA, Russia, Germany, and Italy. The largest collaboration is the International Program of Scientific Cooperation between Armenia and France (***Jumelage*** in 2000-2003, Coordinator: Daniel Kunth; and ***PICS*** in 2007-2009, Coordinator: Georges Alecian), which supports travels of the Armenian scientists to France and vice versa. During 2000-2008, some 40 missions have been accomplished to various French observatories and institutes by R.R. Andreatsyan, K.S. Gigoyan, A.A. Hakobyan, S.A. Hakopian, N.D. Melikian, A.M. Mickaelian, T.H. Movsessian, A.G. Nikoghossian, E.H. Nikogossian, A.R. Petrosian, L.A. Sargsyan, and G.T. Ter-Kazarian (as well as D.M. Sedrakian from the YSU). These missions and collaborative research resulted in many joint publications, particularly in *A&A*. A **French-Armenian colloquium** is planned for September 2009 in Byurakan to discuss the achieved results and possibilities of further collaboration.

Due to the international contacts, several **collaborative research grants** have been received, like large grants from the European **INTAS** (T.Yu. Magakian, H.A. Harutyunian), **US CRDF** (A.M. Mickaelian), and the **US NFSAT** (T.Yu. Magakian), which support a research group typically for two years (individual financial support, equipment, travels, etc.). There is a large collaboration with "**La Sapienza**" **Universita di Roma** (Italy; Enrico Massaro, et al.) for the DFBS (PI: A.M. Mickaelian), which supported 15 missions to Rome during 2001-2007; including 2 short-term stays of L.A. Sargsyan for joint research. A.R. Petrosian collaborates with the **Space Telescope Science Institute** (STScI, Baltimore, USA; John MacKenty, Brian McLean, Ron Allen, et al.) on Markarian galaxies, Local starbursts, and Supernovae, and gets fellowships for joint research, typically 3-6 months annually. Collaboration with the **Cornell University** (Ithaca, NY, USA; Jim Houck, Dan Weedman, et al.) is in frame of the DFBS and studies with Spitzer Space Telescope (SST); several 1-2 months missions have been accomplished in 2003-2008 by A.M. Mickaelian, L.A. Sargsyan, and L.R. Hovhannisyan. Other collaboration (mainly on studies of ROSAT sources) is with **Hamburger Sternwarte** (HS, Germany; Dieter Engels, et al.); several missions have been supported by DFG grants for A.M. Mickaelian, S.K. Balayan, and L.R. Hovhannisyan. In frame of the Armenian Virtual Observatory (ArVO) and its science projects, A.M. Mickaelian collaborates with the **French VO** team (based in Paris, Lyon-HyperLEDA, and Strasbourg-CDS) and has been awarded ANR fellowships in 2006-2007. K.S. Gigoyan (2006) and T.H. Movsessian (2008) were awarded **DAAD fellowships** to visit and work in Germany for 2 months each. A.A. Hakobyan has three times visited Institut d'Astrophysique de Paris (IAP, France) in 2006-2008 for 3 months each time as a joint French-Armenian post-graduate student supported by the **French Embassy in Yerevan** (supervisors: A.R. Petrosian and D. Kunth).

Collaboration with the **Special Astrophysical Observatory** (SAO, Russia; S.N. Dodonov, V.R. Amirkhanian) supports the project of renovation of the Byurakan 1m Schmidt telescope (Head of the Laboratory: S.K. Balayan). This project is also supported by the sponsorship from the **VivaCell** telephone company. This sponsorship has been also used for the 2.6m telescope and small telescopes in Byurakan. New collaboration between BAO and the **Institute of Informatics and Automation Problems** (Armenian National Acad. Sci., Yerevan; Yu.H. Shukurian, V.S. Sahakyan, H.V. Astsatryan, et al.) on the ArVO and Grid led to two grants from the International Scientific and Technology Center (ISTC), one with Georgian colleagues.

In addition to the international collaboration and resulting support, since 2001 there are regular **ANSEF grants**. The **Armenian National Science and Education Fund (ANSEF)** was established in 1999. **Prof. Yervant Terzian** was one of the organizers and since the beginning is the Chair of ANSEF Research Council. These grants may be used for individual support, equipment, travels, etc. and are extremely useful for encouraging and supporting small projects. During 2001-2009, 13 PIs from Byurakan have been awarded 18 ANSEF grants, USD 5000 each; R.R. Andreatsyan (2), S.K. Balayan, S.A. Hakopian, M.A. Hovhannisyan, E.Ye. Khachikian, T.Yu. Magakian, A.P. Mahtessian, A.M. Mickaelian (3), T.H. Movsessian, E.H. Nikogossian (2), G.A. Ohanian, G.T. Ter-Kazarian (2), and V.P. Zalinian. Along with pure research projects, some grants supported technical developments at the 2.6m and 1m Schmidt telescopes, and the DFBS. Several dozens of publications have appeared in frame of the projects supported by ANSEF. Though this article is devoted to research in Byurakan, anyway let us mention that 6 more ANSEF grants in astrophysics have been awarded to A.A. Sadoyan, A.A. Saharian (2), D.M. Sedrakian, K.M. Shahabasian, and Yu.L. Vartanian from the Yerevan State University (YSU), where astronomy is rather active (we would like to have another article on astronomy at the YSU).

During 2000-2008, the Byurakan astronomers have organized several **scientific meetings** that also supported our research and helped establishing new collaborations. 13 meetings were held in Byurakan and one at YSU, among them the IAU Col. #184 (*AGN Surveys*) in 2001, the Joint European and National Astronomical Meeting (JENAM-2007) in 2007 at YSU, the *Astrofizika* journal 40th anniversary (in 2005), Byurakan Observatory 60th anniversary (in 2006) and Ambartsumian's 100th anniversary (in 2008) meetings, two international summer schools in 2006 and 2008, the XIII Joint Colloquium between BAO and the Abastumani Observatory (Georgia), individual ArAS annual meetings in 2002, 2004, and 2005 (others were combined with the abovementioned meetings), and some small meetings. **JENAM-2007** was the largest scientific event ever organized in Armenia; there were 6 plenary sessions, 8 EAS Symposia, 5 Special Sessions, and EAS General Meeting, 256 participants from 31 countries, 358 contributions were made, including 79 invited talks. The Byurakan astronomers had 3 invited and 18 contributed talks, and 14 posters. **IAU Col. #184** was another important meeting: 92 participants from 16 countries, 87 contributions, including 27 invited talks; 2 invited talks and 14 posters by the Byurakan scientists. **BAO-60** and **Ambartsumian-100** meetings also were enough representative; 72 and 89 participants from 14 and 12 countries, and 26 and 44 contributions, respectively. In 2006, we started the **Byurakan International Summer Schools (BISS)**, and two high-level schools were organized: First BISS in 2006 and Second BISS in 2008. In each school there were 20-25 foreign participants (lecturers and students), as well as they were rather useful for our students who got in contact with foreign scientists and students. In addition, a school for YSU students was organized in 2005, and the next one is going to be organized this year in July (see section "*Future meetings*" of this Newsletter, p. 19). The Byurakan Observatory is the host for the final stage of the **astronomical school Olympiads**, which are being held annually typically in April (Chair of the Jury is *Dr. A.A. Akopian*).

The Byurakan meetings have been supported by the international organizations (IAU, EAS, ESA) and funds (INTAS, NFSAT, ISTC) and local organizations (Armenian National Acad. Sci.) and companies (Apaven, Unicom, Web, Antares, Editprint, Aray, HSBC, Armenpress, etc.), as well as Embassies of Germany, Italy, and UK in Yerevan.

During these years, mainly due to the meetings, many **famous scientists and other important guests** have visited Byurakan: Felix Aharonian (Ireland), Georges Alecian (France), Danielle Alloin (France), Robert Antonucci (USA), Cesare Barbieri (Italy), Thierry Courvoisier (Switzerland), Roc Cutri (USA), Michel

Dennefeld (France), Dieter Engels (Germany), Francoise Genova (France), Richard Green (USA), Luis Ho (USA), John Hutchings (Canada), Vsevolod Ivanov (Russia), Igor Karachentsev (Russia), Joachim Krautter (Germany), Ralph Krikorian (France), Daniel Kunth (France), Andrew Lawrence (UK), Richard Lovelace (USA), John Mather (USA; Nobel prize winner 2006), Michel Mayor (Switzerland), Joseph Mazzarella (USA), Guy Monnet (Germany), Jayant Narlikar (India), Paolo Padovani (Germany), Jean-Claude Pecker (France), Vahé Petrosian (USA), Bo Reipurth (USA), David Sanders (USA), Yervant Terzian (USA), Gerard Vauclair (France), Sylvain Veilleux (USA), Wolfgang Voges (Germany), Dan Weedman (USA), Lutz Wisotzki (Germany), and many others.

Byurakan astronomers have also **participated in other international meetings**, including the IAU General Assemblies in 2000, Manchester, UK (R.R. Andreasyan, E.Ye. Khachikian, A.M. Mickaelian), in 2003, Sydney, Australia (E.Ye. Khachikian, A.M. Mickaelian), and in 2006, Prague, Czech Republic (H.A. Harutyunian, A.M. Mickaelian), IAU Symposia and Colloquia (not counting IAU C184 in Byurakan; A.A. Akopian, R.R. Andreasyan, E.Ye. Khachikian, T.Yu. Magakian, N.D. Melikian, A.M. Mickaelian, and E.H. Nikogossian), JENAMs in 2000-2008 (not counting JENAM-2007 in Yerevan; R.R. Andreasyan, A.N. Harutyunyan, M.A. Hovhannisyanyan, T.Yu. Magakian, A.M. Mickaelian, T.H. Movsessian, and V.H. Movsisyan), and many other meetings, as well as summer schools (S.A. Ghazaryan, E.R. Hovhannessian, L.R. Hovhannosyan, L.A. Sargsyan, P.K. Sinamyan). Some of our scientists have been invited for seminars at European and American astronomical centers.

Many Byurakan astronomers are part-time **lecturers at the YSU** teaching important subjects of astronomy and astrophysics: A.A. Akopian, R.R. Andreasyan, A.L. Gyulbudaghian, H.A. Harutyunian, T.Yu. Magakian, V.H. Malumian, A.M. Mickaelian, T.H. Movsessian, A.G. Nikoghossian, A.R. Petrosian, H.V. Pikichian, and A.G. Yeghikian. Many students have defended diploma theses under the supervision of these scientists. The YSU students regularly visit Byurakan for summer practice and acquaintance with the research of our scientists (for many years, the YSU Department of Astrophysics was chaired by *Prof. M.A. Kazarian*, and during the recent two years, by *Prof. A.K. Avetisyan*).

The **Council for Scientific Degrees** has been active in Byurakan during all these years (*Prof. E.S. Parsamian* is the Chair, and A.G. Gyulbudaghian, E.Ye. Khachikian, T.Yu. Magakian, V.H. Malumian, and A.G. Nikoghossian, are members from BAO). During 2000-2008, their PhD degrees received: G.H. Broutian (2000), E.H. Nikoghossian (2002), S.A. Hakopian (2002), and S.K. Balayan (2004), and Doctor of Science degrees, A.L. Gyulbudaghian (2000) and T.Yu. Magakian (2001).

The **Armenian Astronomical Society (ArAS)** was created in 2001 (formally established in 1999) and supported many activities in Byurakan, including organization of meetings, summer schools, etc. Out of 51 BAO researchers, 26 are ArAS members, who are among the most active scientists. Byurakan astronomers are members of other astronomical societies and international organizations as well; 15 are IAU members, 17 are EAS members, and 7 are EAAS members. Members of all these three organizations are: T.Yu. Magakian, N.D. Melikian, A.M. Mickaelian, E.S. Parsamian, and A.R. Petrosian. All they are ArAS members as well.

At present a full database of all publications, scientific results and achievements by the Armenian astronomers is being created, which will enter the *"Encyclopedia of the Armenian astronomy"* DVD to be released this year.