

ArAS News

NEWSLETTER

ARMENIAN ASTRONOMICAL SOCIETY (A r A S)













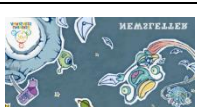






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Editor: Sona FARMANYAN

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50TH ANNIVERSARY OF MARKARIAN SURVEY

Areg M. Mickaelian

Markarian survey was the first systematic survey for active galaxies and was a new method for search for such objects. Until now, it is the largest objective prism survey of the sky (17,000 deg²). It was carried out in 1965-1980 by B.E. Markarian and colleagues and resulted in discovery of 1515 UV-excess (Markarian) galaxies. They contain many active galaxies, as well as powerful γ -, X-ray, IR and radio sources, BCDGs and interacting/merging systems. They led to the classification of Seyfert galaxies into Sy1 and Sy2 and the definition of Starbursts. Markarian survey (or the First Byurakan Survey, FBS) also served as a basis for search for UVX stellar objects, late-type stars and optical identification of IR sources. At present the survey is digitized and DFBS database is available.

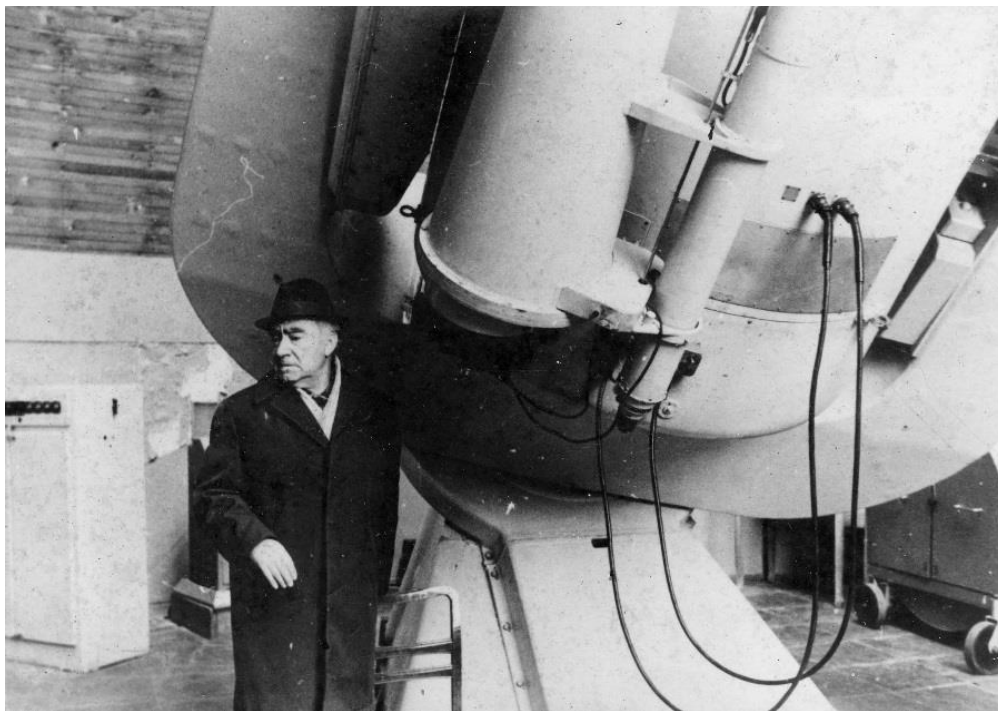
On November 15, 1965, Benjamin Markarian obtained the first plate of the future spectroscopic survey that later became known as Markarian Survey or the First Byurakan Survey (as the Second one was conducted later on in 1974-1991). It was a low-dispersion survey carried out with BAO 1m Schmidt telescope and 1.5° prism, using Kodak IIaF (and some other type) plates resulting in $\sim 50\text{\AA}$ spectral resolution (Markarian 1967). Almost 2000 plates were obtained, covering 17,056 deg². The idea was to select galaxies with UV-excess (UVX) based on their SEDs by eye inspection by means of 7× lens. In 1969, Valentin Lipovetski joined the project, and in 1974, Jivan Stepanian was involved. Each 100 selected galaxies were published as a list in the journal *Astrofizika/Astrophysics*, and 15 consecutive lists were published in total during 1967-1981.



B.E. Markarian (centre), V.A. Lipovetski (right) and J.A. Stepanian (left).

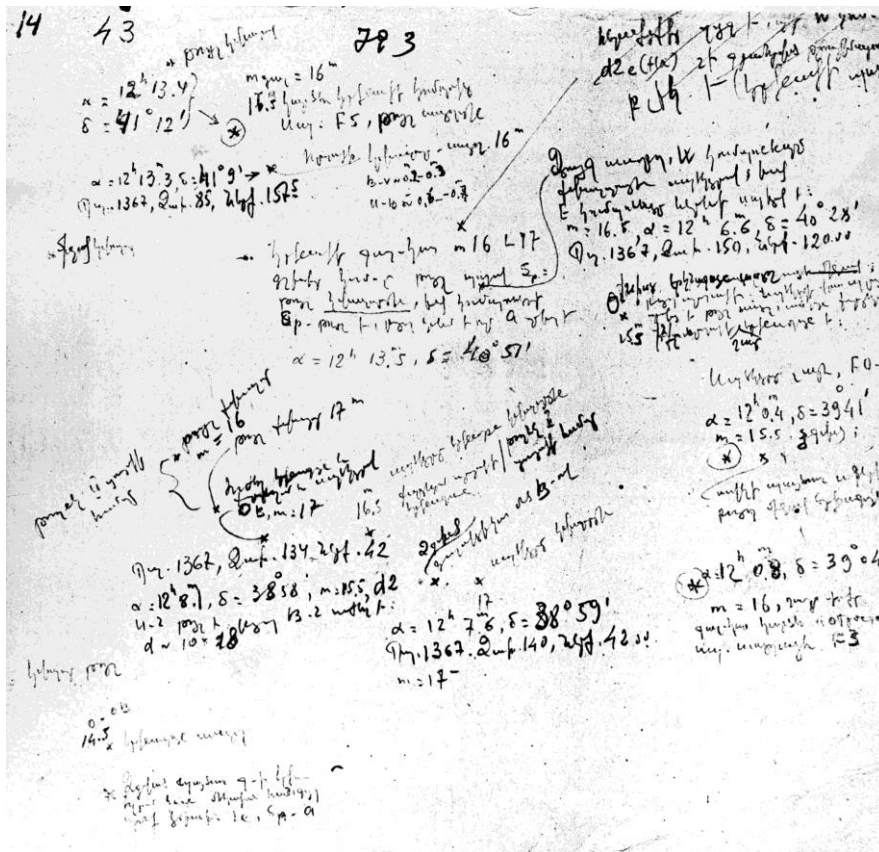
The history of active galaxies goes back to 1943, when Carl Seyfert published a list of 8 galaxies with broad emission lines (Seyfert 1943). Later on radio galaxies were discovered (Bolton et al. 1949). In 1956 Guillermo Haro published a list of blue galaxies (Haro 1956). Viktor Ambartsumian (1958) paid attention to some active processes and observing data connected with the central regions of some galaxies: blue/UV colours, emission lines, radio emission, outflows, etc. He predicted that more such objects should exist and new forms of activity may be found; this idea was in fact the very beginning of the unified scheme suggested much later by Antonucci & Miller (1985). Similar discussions and direct indication on massive nuclei were

given by Woltjer (1959). Predicted by Ambartsumian new types of active galaxies were the quasi-stellar objects (QSOs) discovered in 1963 (Schmidt 1963) and the list of galaxies with anomalous colours (Markarian 1963). To discover new such objects, find out what was their fraction and provide some statistics for further studies, Markarian conducted in 1965 a survey for UVX galaxies. Some more types of active galactic nuclei (AGN) and other active galaxies were found in further works, such as BL Lac objects (Schmitt 1968), Starburst (SB) galaxies (Weedman 1977), LINERs (Heckman 1980), etc.



Benjamin Markarian at Byurakan 1m Schmidt telescope.

The big variety of AGN types allows speaking about “AGN zoo”, as all these types have certain peculiarities and need a reliable classification (for AGN types and classifications, see Mickaelian 2015). First attempts to classify Seyferts were done in mid-1960s, when differences between NGC 4151 and NGC 1068 were noticed (prototypes of Sy1 and Sy2). Later on Weedman & Khachikian (1968) obtained the first spectra of Markarian galaxies and classified Seyferts into Sy 1/2 classes. Osterbrock (1981) introduced subclasses of Seyferts: 1.0, 1.2, 1.5, 1.8, 1.9 and 2.0. Later on Osterbrock & Pogge (1985) found galaxies with Sy 1 features having narrow Balmer and other permitted lines, Narrow-Line Seyfert 1 (NLS1) galaxies; these objects also show strong FeII and soft X-ray. We use NLS also for other subtypes of Sy1 (NLS1.2, NLS1.5, etc.), as well as NLQSOs have been observed. For narrow line AGN (Sy2, LINER and SB), the classification is given by so called diagnostic or BPT (Baldwin, Phillips, Terlevich) diagrams (Baldwin et al. 1981; Veilleux & Osterbrock 1987). Anyway, due to the variety of their types and forms of activity, there is no final classification; very often classes refer to various properties, such as the morphology, optical spectrum, colour and/or spectral energy distribution (SED), radio loudness, polarization, etc.



One of Markarian's plates envelopes with notes on selected objects.

The selection of the low dispersion (1800Å/mm at Hy) provided a chance to follow SED and notice some broad (both emission and absorption) lines on one hand, and avoid overlaps on the other hand. Low-dispersion spectra cover the range 3400-6900Å, and there is a sensitivity gap near 5300Å, dividing the spectra into red and blue parts. It is possible to compare these parts, easily distinguishing red and blue objects.

2050 Kodak IIAF, IIAF, IIF, and 103aF photographic plates in 1133 fields (4°×4° each, the size being 16cm×16cm) have been taken. FBS covers 17,000 deg² of all the Northern Sky and part of the Southern Sky at high galactic latitudes ($|b| > 15^\circ$). The limiting magnitude on different plates changes in the range of 16.5-19.5 in V, however for the majority it is 17.5-18. Each FBS plate contains low-dispersion spectra of some 15,000-20,000 objects, and there are some 20,000,000 objects in the whole survey.

We give in Table 1 the main observing and resulting characteristics of the FBS – Markarian survey. Though FBS spectra seem to be very similar, a thorough eye inspection with the help of 7× lens provided opportunity to select peculiar spectra. Such spectra altogether are less than 0.1% among all in the FBS fields.

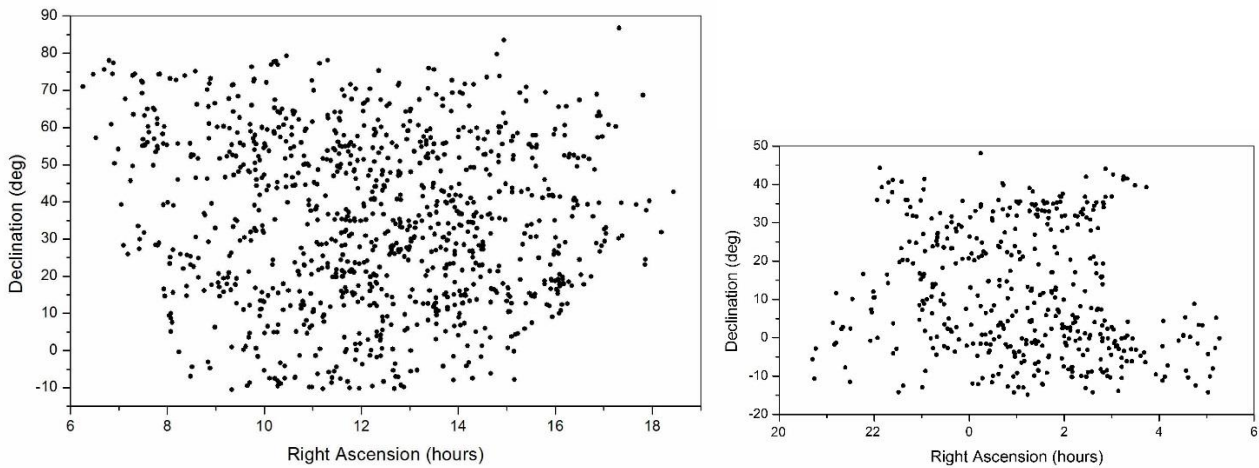
Markarian survey was an outstanding study for all extragalactic (as well as galactic) astronomy; its main features may be given as:

Table 1: Main observing and resulting characteristics of the FBS – Markarian survey.

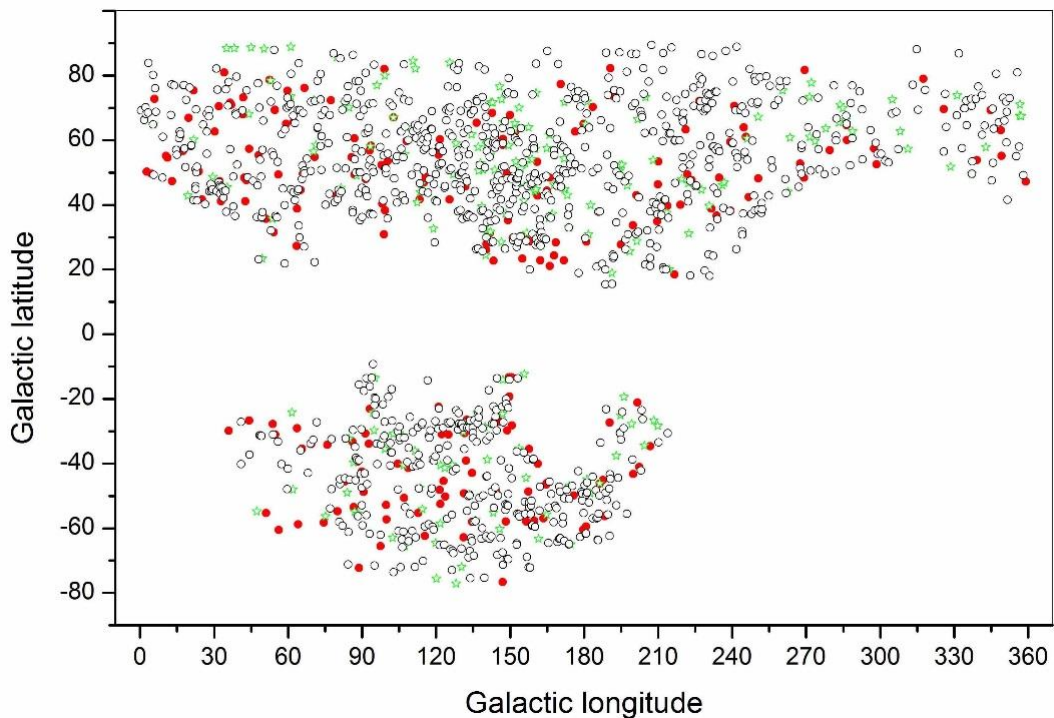
Items	Description
Authors	B.E. Markarian, V.A. Lipovetskiy, J.A. Stepanian
Years	1965-1980
Telescope	BAO 102/132/213cm (40"/52"/84") Schmidt
Equipment	1.5° objective prism
Emulsions	Eastman Kodak IIAF, IIaF, IIF, 103aF
Plate size	4°×4°, 16cm × 16cm
Spectral range	3400-6900 ÅÅ with a sensitivity gap at 5300Å
Dispersion	1800 Å/mm at H _γ , 2500 Å/mm near H _β
Scale	96.8"/mm
Spatial resolution	2.4"
Limiting magnitude	17.5 ^m -18.0 ^m in V
Sky area	δ>-15°, all RA except the Milky Way (b >15°)
Total coverage	17,056 deg ²
Number of fields	1139 (each 16 deg ²), distributed by 28 declination zones
Number of plates	1874 (at least one plate with m=17 in each field)

- Markarian survey is the first systematic objective-prism survey,
- It is the largest objective-prism survey of the Northern sky (17,000 deg²),
- It introduced a new method of search for active galaxies,
- Revelation of 1517 UVX galaxies: some 300 AGN and some 1000 HII galaxies,
- Classification of Seyferts into Sy1 and Sy2 types (Weedman & Khachikian 1968),
- Definition of Starburst (SB) galaxies (Weedman 1977),
- Discovery of many new Blue Compact Dwarf Galaxies (BCDG),
- Revelation of 1103 FBS Blue Stellar Objects (BSOs; Mickaelian 2008) and 1045 Late-type Stars (Gigoyan & Mickaelian 2012),
- Optical identification of 1577 IRAS sources (samples of Byurakan-IRAS Galaxies (BIG; Mickaelian & Sargsyan 2004) and Byurakan-IRAS Stars (BIS; Mickaelian & Gigoyan 2006)); discovery of many new AGN and ULIRGs.
- Markarian survey led to many other objective prism surveys with better spectral resolution and deeper limiting magnitudes, including the Second Byurakan Survey (SBS, Markarian et al. 1983, Stepanian 2005).

Markarian galaxies have nuclei with excessive amounts of ultraviolet emission compared with other galaxies (so-called UVX). So far, 1517 Markarian galaxies are known, as well as many more similar UVX galaxies exist. Beside the series of 15 papers in *Astrofizika/Astrophysics*, they are listed in several catalogs, providing accurate positional, morphologic, photometric, multiwavelength data and images. These are Kojoian et al. 1978-1984 (accurate optical positions), Mazzarella & Balzano 1986 (the first catalog of Markarian galaxies), Markarian et al. 1989 (the First Byurakan Survey, a catalogue of 1517 galaxies with UV-continuum), Bica et al. 1995 (a multifrequency radio continuum and IRAS faint source survey of Mrk galaxies), Markarian et al. 1997 (the FBS Catalogue of Markarian galaxies) and Petrosian et al. 2007 (optical database and atlas).



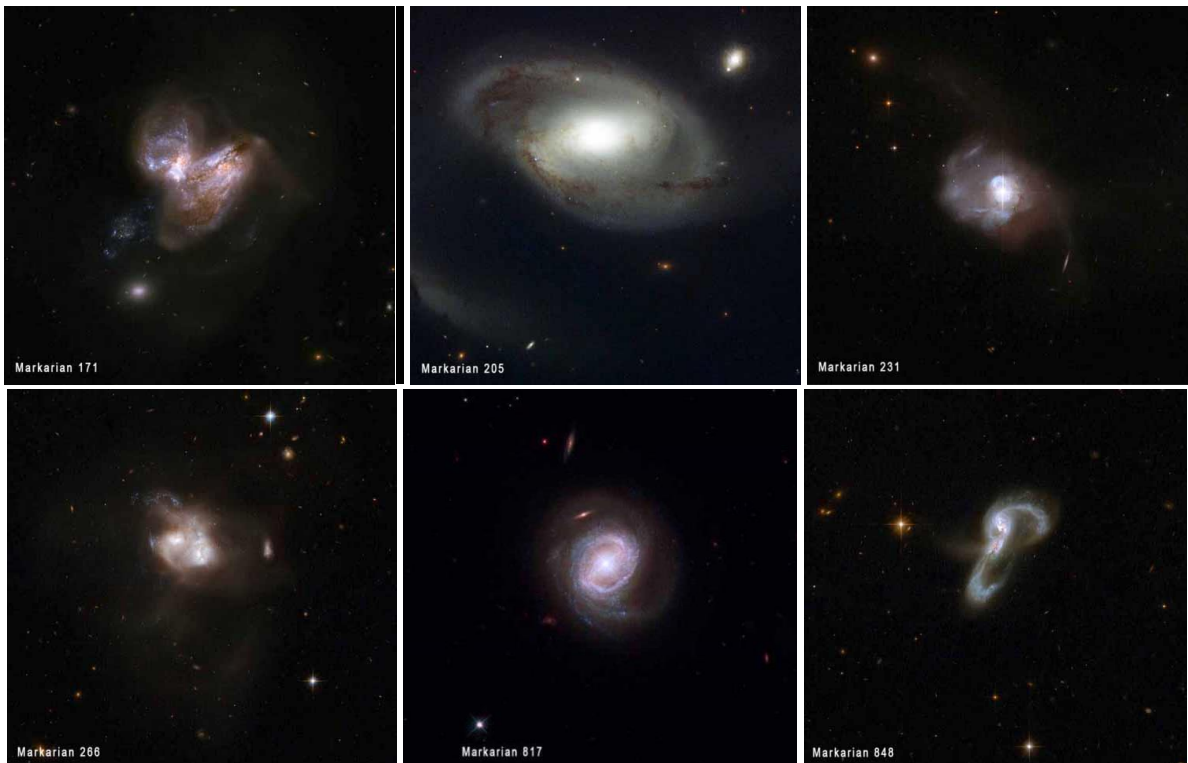
Distribution of Markarian galaxies on the celestial sphere by equatorial coordinates.



Distribution of Markarian galaxies on the celestial sphere by Galactic coordinates l_{II} and b_{II} . Filled circles are AGN, stars are Starburst and HII galaxies, and open circles are galaxies without a sign of activity.

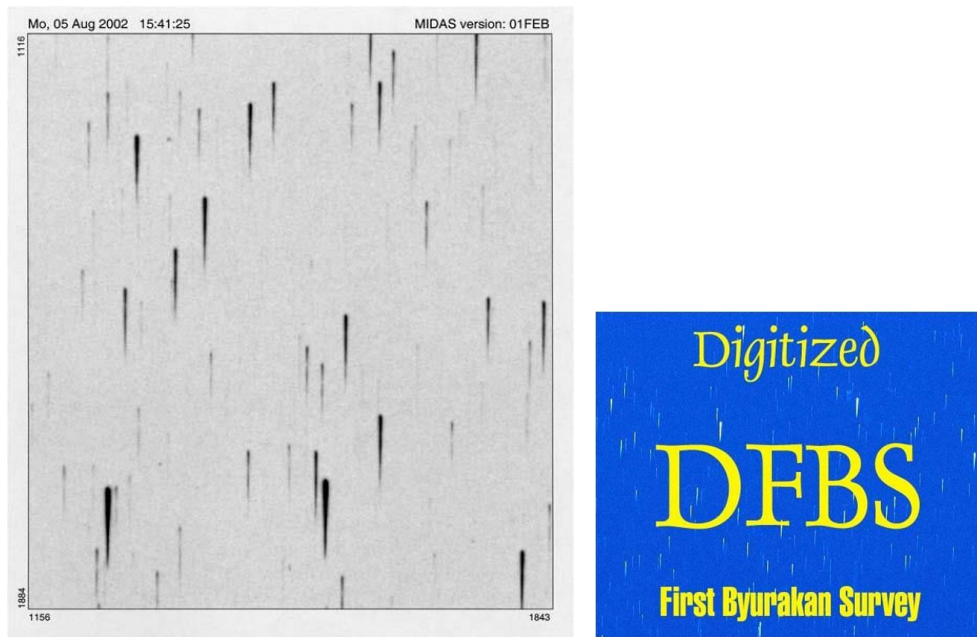
Markarian galaxies are rather important for various extragalactic studies, such as: Mrk 231 is the most luminous infrared galaxy (ULIRG) in the Local Universe, Mrk 116 is the most metal-deficient blue compact dwarf galaxy (BCDG) (most of the BCDGs are Mrk and SBS galaxies), Mrk 421 and 501 are among the most powerful sources, etc. Below we give some selected Markarian galaxies that are most important for various matters of extragalactic astronomy:

Mrk galaxies	Description
Mrk 231	the closest ULIRG, BAL QSO and most luminous IR galaxy in the Local Universe
Mrk 421, 501	are among the highest known energy sources
Mrk 116 (=IZw18)	the most metal-deficient (BCDG) (Mrk and SBS)
Mrk 938	the first dynamic merger discovered observationally
Mrk 110	intermediate between NLS1 and BLS1 (FWHM=4900 km/s); understanding BLS1s and NLS1s differences
Mrk 6	shows variations of spectral lines typical of different types of objects (Sy2 & Sy1); very high H column density in X-rays
Mrk 926	one of the rare Sy1 galaxies having LINER properties
Mrk 766	one of the most important NLS1 galaxies
Mrk 273	a wonderful double-double nuclei galaxy
Mrk 266	has a multiple structure nuclear region
Mrk 231, 507	super strongest FeII emitters ($\text{FeII } \lambda 4570 / \text{H}\alpha > 2$)
Mrk 530, 993, 1018	change their spectra from Sy1.9 to Sy1.0



Some important Markarian galaxies.

Many more UVX and emission-line galaxies have been discovered in similar to Markarian surveys or by other studies. These are Arakelian galaxies having high surface brightness (Arakelian 1975), Kazarian UVX galaxies (Kazarian et al. 2010), the University of Michigan emission-line galaxies (UM; MacAlpine et al. 1982), Case Low-Dispersion Northern Sky Survey galaxies (CG; Pesch et al. 1991), the Montreal blue galaxies (Coziol et al. 1994), SBS UVX and emission-line galaxies (Stepanian 2005), Kiso UV galaxies (KUG; Miyauchi-Isobe et al. 2010), Hamburg/SAO emission-line galaxies (Pustilnik et al. 2005), GALEX UV-luminous galaxies (Hoopes et al. 2007), etc.



A scanned piece of FBS plate and DFBS logo.

The Digitized First Byurakan Survey (DFBS; Mickaelian et al. 2007; Massaro et al. 2008) is the digitized version of the Markarian survey (or FBS). It is a collaborative effort of the Byurakan Astrophysical Observatory, Universita di Roma “La Sapienza” and MIGG s.r.l. (Italy), Cornell University (USA), and Hamburger Sternwarte (Germany). It included scanning of the plates, high accuracy (1" rms) astrometric solution, extraction software for images and spectra, photometric and wavelength calibration of the spectra, classification, creation of DFBS catalog and database, construction of user interface and webpage. Later on, the Armenian Institute of Informatics and Automation Problems (IIAP) also joined the project to reproduce the DFBS database in Armenia in frame of the Armenian VO project. 1874 FBS plates have been scanned. We give in Table 2 the main scanning and resulting characteristics of the DFBS.

Table 2: *Main scanning and resulting characteristics of the DFBS.*

Items	Description
Teams	Byurakan Astrophysical Observatory, La Sapienza Universita di Roma, Cornell University
Years	2002-2005
Instrument	Epson Expression 1680 Pro scanner
Scanning options	1600 dpi (15.875 μm pix size), 16 bit, transparency mode, “scanfits”
Plate size	9601 \times 9601 pix, 176 MB file
Spectra	107 \times 5 pix (1700 μm in length)
Dispersion	33 $\text{\AA}/\text{pix}$ average (22-60 $\text{\AA}/\text{pix}$), 28.5 at H_γ
Spectral resolution	50 \AA (average)
Astrometric solution	1" rms accuracy
Scale	1.542"/pix
Photometry	0.3 ^m accuracy
Data volume	1874 plates, ~400 GB
Number of objects	~20,000,000 (~40,000,000 spectra)

Markarian survey was the first systematic search for active galaxies, and Markarian galaxies led to discovery of many new AGN, spectral classification of Seyfert galaxies and definition of a new class of active galaxies, Starburst ones. Until now, Markarian survey is the largest area spectroscopic survey and the DFBS contains the largest amount of spectra (some 20,000,000 objects).

We give in Table 3 a comparison of the main characteristics of large spectroscopic surveys. The first five surveys are objective prism ones and have been done using Kodak emulsions and only SDSS (Alam et al. 2015) has been done with CCD using u, g, r, i, and z filters. In all cases, the most important goals were to discover active galaxies; SDSS has carried out the largest ever galaxy redshift survey (~ 2.5 million objects) and also has discovered some 300,000 QSOs. In addition, such surveys are ideal tools for optical identifications of X-ray, IR, and radio sources; such projects have been carried out using FBS (Mickaelian 1995) and HQS (Zickgraf et al. 2003; Mickaelian et al. 2006).

Markarian survey led to the discovery of 1517 UVX galaxies, including some 300 AGN and some 1000 HII galaxies. Classification of Markarian galaxies provided Sy1 and Sy2 types and the definition of Starburst galaxies. Many new BCDG were discovered as well. The continuation of the FBS for stellar objects revealed FBS Blue Stellar Objects and FBS Late-type Stars, as well as optical identifications of IRAS sources have been carried out resulted in discovery of new ULIRGs and AGN. Markarian survey also led to many other objective prism surveys.

Table 3: Comparison of the main characteristics of large spectroscopic surveys.

Survey	Years	Telescope Equipment	Sky area Surface (deg^2)	Disp. H_γ $\text{\AA}/mm$	Sp. range \AA	V_{lim}
FBS	1965-1980	BAO 1m Schmidt 1.5 prism	$\delta > -15, b > 15$ 17,056	1800	3400-6900	17.5
SBS	1978-1991	BAO 1m Schmidt 1.5, 3, 4 prisms	$49 < \delta < 61, b > 30$ 965	1800/900/280	3400-6950	19.0
Case	1983-1995	KPNO 91cm 1.8 prism	$\delta > 30, b > 30$	1350	3400-5300	18.0
HQS	1985-1997	CAHA 81cm 1.7 prism	$\delta > 0, b > 20$ 14,000	1390	3400-5300	19.0
HES	1990-1996	ESO 1m Schmidt 4 prism	$\delta < 2.5, b > 30$ 9,000	280	3400-5300	18.0
SDSS	2000-2015	Apache Point 2.5m Double MOS	$\delta > 0, b > 30$ 14,555	res. 2.5\AA	3000-10800	22.0

Markarian galaxies are reliable objects for MW studies of active galaxies, as they are bright enough and have been detected in all ranges of electromagnetic radiation; from γ -ray to radio. In one of the recent works, we have collected all available MW data from all-sky or large-area catalogs and have built MW SEDs for Markarian galaxies using 38 photometric points (Fermi, INTEGRAL, ROSAT, GALEX FUV/NUV, UBV, POSS I/II OjEN, SDSS ugriz, 2MASS JHK, WISE w1/w2/w3/w4, Spitzer IRAC/MIPS, AKARI 9/18/65/90/140/160 μm , IRAS 12/25/60/100 μm , radio 4.85 and 1.4 GHz, 843, 612, 326, 152 and 38 MHz). These SEDs provide a possibility to group objects by their shapes and compare to existing physical properties to find various relations and refine the AGN classifications.

Our outstanding scientist Viktor Ambartsumian wrote about Markarian galaxies: *“The discovery of Markarian galaxies is a great achievement of our science. Now more and more astronomers both in our country and all over the world seek to study the nature of these objects in more details on the world largest telescopes...”*. Ambartsumian also compared Markarian survey plates with the treasures of Matenadaran – ancient manuscripts collection.

In 2011, Markarian Survey and its digitized version, DFBS, entered UNESCO’s **“Memory of the World” International Register**. It is one of the rarest science treasures that is included in UNESCO lists together with world cultural heritage masterpieces.



Certificate of inclusion of Markarian Survey in UNESCO’s “Memory of the World” International Register.

IAU Colloquium #184 in 2001 was dedicated to Markarian and IAU Symposium #304 in 2013 was dedicated to Markarian’s 100th anniversary, both related to Markarian Survey and Multiwavelength AGN Surveys in general. An international symposium dedicated to the 50th anniversary of Markarian Survey and 10th anniversary of Armenian Virtual Observatory (ArVO, based on DFBS) was held recently, on 5-8 Oct 2015 in Byurakan on *“Astronomical Surveys and Big Data”*.

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TEN YEARS OF ARMENIAN VIRTUAL OBSERVATORY (ARVO)

Areg M. Mickaelian

ArVO Project Manager, IVOA Executive Committee Member



Armenian Virtual Observatory (ArVO, www.aras.am/Arvo/arvo.htm) was created 10 years ago, in 2005, when after the accomplishment of the **Digitized First Byurakan Survey (DFBS, www.aras.am/Dfbs/dfbs.html)** we had enough resources to run a VO project and contribute in the **International Virtual Observatory Alliance (IVOA, www.ivoa.net)**. ArVO is a project of Byurakan Astrophysical Observatory (BAO) aimed at construction of a modern system for data archiving, extraction, acquisition, reduction, use and publication. ArVO technical and research projects include Global Spectroscopic Database, which is being built based on DFBS. Quick optical identification of radio, IR or X-ray sources will be possible by plotting their positions in the DFBS or other spectroscopic plate and matching all available data. Accomplishment of new projects by combining data is so important that the International Council of Scientific Unions (ICSU) recently created **World Data System (WDS, www.icsu-wds.org/)** for unifying data coming from all science areas, and BAO has also joined it due to DFBS and ArVO projects.

Virtual Observatory (VO) is a collection of interoperating data archives and software tools which utilize the Internet to form a scientific research environment in which astronomical research programs can be conducted. In the same way as a real observatory consists of telescopes, each with a collection of unique astronomical instruments, VO consists of a collection of data centres each with unique collection of astronomical data, software systems and processing capabilities. The main goal is to allow transparent and distributed access to data available worldwide. This allows scientists to discover, access, analyze, and combine space and laboratory data from heterogeneous data collections in a user-friendly manner.

Virtual Observatories have been created in a number of countries since 2000, and IVOA was created in 2002 as a coordinating body to develop and agree the vital interoperability standards upon which the VO implementations are constructed. So far, countries with most developed astronomy have VO projects and Armenia is among these 17 ones (in addition 2 European projects, ESO and ESA, are IVOA members). ArVO was accepted in IVOA in 2005 and is one of its projects until now.



International Virtual Observatory Alliance (IVOA)

IVOA software is aimed at data discovery (Aladin, Astroscope, VOExplorer, DataScope), spectral analysis (VOSpec, SPLAT, EURO-3D, Specview), data visualization and reduction (VOPlot, Topcat, VisIVO, STILTS), spectral energy distribution (SED) construction and fitting (VOSED, Yafit, easy-z, GOSSIP), etc.

The development of ArVO project includes Armenian astronomical archives and present telescope data preservation, cross-correlations of direct images and low-dispersion spectra, creation of joint low-dispersion spectral database (DFBS/DSBS/HQS/HES/Case) and a number of other technical and scientific projects.

ARMENIAN VIRTUAL OBSERVATORY
 Հայկական Վիրտուալ Աստղադիտարան

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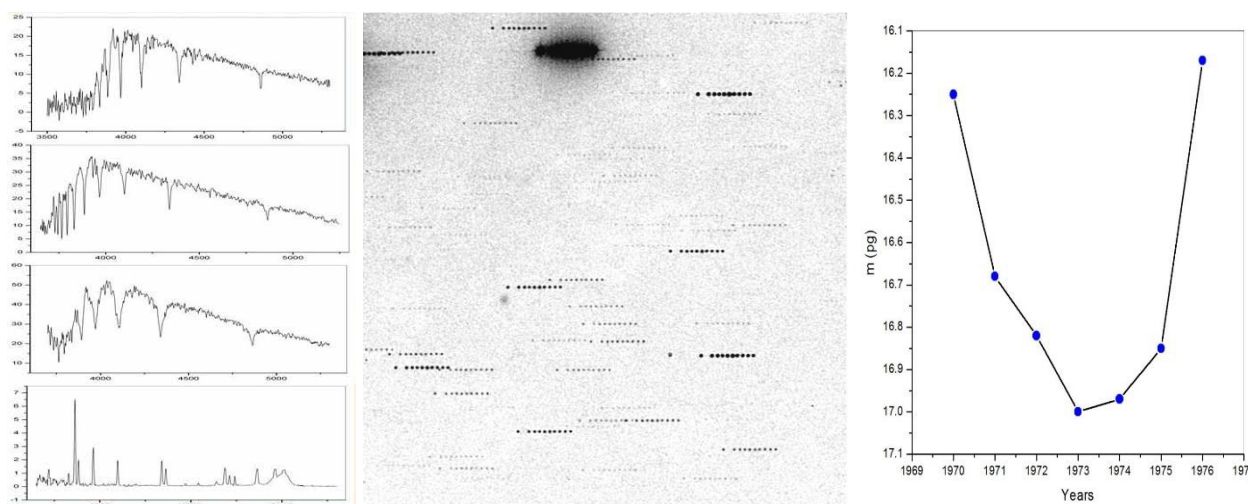
Last updated: November 28, 2015.

Data Discovery	
	Aladin is an interactive software sky atlas allowing the user to visualize digitized images of any part of the sky, to superimpose entries from astronomical catalogs or personal user data files, and to interactively access related data and information from the SIMBAD, NED, VizieR, or other archives for all known objects in the field. Aladin is particularly useful for multi-spectral cross-identifications of astronomical sources, observation preparation and quality control of new data sets (by comparison with standard catalogues covering the same region of sky).
DataScope	Use DataScope to find everything that's known about a given target or region of the sky. DataScope will query hundreds of VO-enabled data resources and organize the results for your viewing.
Spectral Analysis	
	VOSpec is the answer from the ESAVO Team to the demand of having a solid tool able to handle Spectra in the VO context as well as providing analysis capabilities and easy integration of spectra coming from different data providers, wavelengths, and different metadata (e.g. units).
	SPLAT is a spectral analysis tool from the Starlink project, which is now maintained by Peter Draper at Durham University. With the assistance of Mark Taylor from the AstroGrid team, this has been "VO-enabled". It understands SAMP messages, can access VOSpace, and can make queries to worldwide spectral services.
	Specview is a tool for 1-D spectral visualization and analysis of astronomical spectrograms. It is written in Java thus can be run anywhere Java is supported. Specview is capable of reading all the Hubble Space Telescope spectral data formats, as well as data from several other instruments (such as IUE, FUSE, ISO, FORS and SDSS), preview spectra from MAST, and data from generic FITS and ASCII tables. It can also read data from Virtual Observatory servers, and read and write spectrogram data in Virtual Observatory SED format. It can also read files in the SPC Galactic format used in the chemistry field.
Data visualisation and handling	
	VOPlot is a tool for visualizing astronomical data. VOPlot is developed in JAVA, and acts on data available in the VOTable format. VOPlot is available as a stand alone version, which is to be installed on the user's machine, or as a web-based version fully integrated with the VizieR database.
	TOPCAT is an interactive graphical viewer and editor for tabular data. Its aim is to provide most of the facilities that astronomers need for analysis and manipulation of source catalogues and other tables, though it can be used for non-astronomical data as well. It understands a number of different astronomically important formats (including FITS and VOTable) and more formats can be added.
	VisIVO is a visualisation and analysis Free software for astrophysical data. VisIVO can handle both observational and theoretical data. It can be used both as a stand-alone application, that acts on local files, and as an interface to the Virtual Observatory framework, from which it can retrieve the data.
	The STIL Tool Set is a set of command-line tools based on STIL, the Starlink Tables Infrastructure Library. It deals with the processing of tabular data.

ArVO webpage

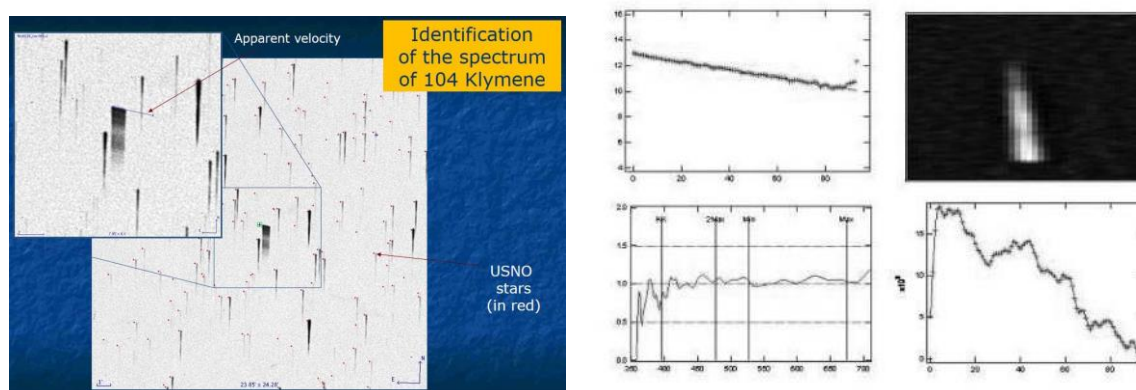
Beside DFBS, some other projects are active in frame of ArVO:

- Digitized Second Byurakan Survey (DSBS, started in 2003),
- Digitization and automated MIDAS reduction of FBS Blue Stellar Objects (BSOs) 2.6m slit spectra (Sinamyán & Mickaelian 2009),
- Digitization of photometric chain observations in Coma field (started in 2004),
- Optical identification of IR sources in Boötes field of Spitzer Space Telescope (SST; 2005, the first science project using DFBS/ArVO) (Hovhannisyan et al. 2009),
- Optical identifications of X-ray, IR and radio sources.



ArVO projects Spectroscopic study of FBS Blue Stellar Objects (BSOs) and Variability of ON 231

Most advanced ArVO project was the search for asteroids in DFBS jointly with IMCEE (Observatoire de Paris, France) colleagues (Thuillot et al. 2007; Berthier et al. 2009), for which VO software Aladin and SkyBote are being used. Bright ($<15^m$ - 16^m) asteroids observed in DFBS are being studied, which are divided into “fast” and “slow” ones depending on their motion during the typical DFBS plate exposure time (20 min), more or less than $3''$. All asteroid spectra are being extracted after they are found by means of SkyBote. Sample spectra are being modeled similar to Solar spectra. Using these spectra and by means of comparisons with other catalogues, new candidate asteroids are being searched. Spectra analysis of asteroid spectra is being accomplished aimed at obtaining definite physical parameters.



ArVO research projects: search for asteroids in DFBS by means of SkyBote software and the software EXATODS – Extraction and Analysis Tool of DFBS Spectra

Since 2008, ArVO also is a **collaboration between BAO and NAS RA Institute of Informatics and Automation Problems (IIAP)**. In frame of this collaboration, a number of joint astrophysical computational projects have been accomplished, including DFBS database and analysis, cross-correlations, etc. *Dr. Hrachya Astsatryan* from IIAP is ArVO Technical Manager and *Aram Knyazyan* defended his PhD thesis on ArVO software development and utilization. Two ISTC grants (A-1451 and A-1606) were won. ArVO also collaborates with Euro-VO, VO-France and some other VO projects.

In frame of this collaboration, ArVO Tools & Services have been developed: **DFBS archive**, **ArVO Data Discovery tool**, **Catalogue cross-matching service**, and **DFBS spectra extraction service** (the latter one still being under development):

1. DFBS archive page gives access to all DFBS data, view the plates and spectra of their sources. More about DFBS archive you can read here (byurakan.phys.uniroma1.it/).
2. ArVO Data Discovery tool gives possibility to access to all available data on it, which is dynamically updating by astronomers and developers (arvo.sci.am/main.php/).
3. Catalogue cross-matching service includes a new cross-correlation program, which is doing the correlation of uploaded or available on server catalogues using as correlation radius for each pair of sources their RMS average error multiplied by some input constant. You can upload your own catalogues, run the service and download the resulting list. The new program is more accurate than the classic cross-correlation methods (arvo.sci.am/crosscorrelation/crosscor.html).
4. Spectra Extraction service will include a tool which extracts astronomical spectra catalogs from uploaded fits files (arvo.sci.am/extraction/index.html).

In 2015, **BAO Plate Archive Project** was conducted, which will significantly complement ArVO data. It is planned that all BAO observational material will be digitized, a full database will be created and BAO observations interactive sky map will be built. The project is also aimed at utilization of the digitized data for further science projects.



ArVO has organized individual sessions at the largest ever meeting held in Armenia, Joint European and National Astronomical Meeting (JENAM-2007), Computer Science and Information Technologies (CSIT-2009) Conference (jointly with IIAP) and other symposia and workshops. A Conference of Young Scientists of CIS Countries “*50 years of Cosmic Era: Real and Virtual Studies of the Sky*” was held in November 2011. An international symposium “Astronomical Surveys and Big Data” (<http://asbd.aras.am/>) dedicated to 50th anniversary of Markarian Survey and 10th anniversary of ArVO was held on Oct 5-8, 2015 in Byurakan, Armenia. We intended to combine astronomers and computer scientists with heavy involvement of astronomical surveys, catalogs, archives, databases and VOs. IVOA and national VO project leaders took part.

ArVO Project Manager Areg Mickaelian has several times attended IVOA Interoperability meetings, and regularly participates in IVOA teleconferences organized several times each year. ArVO young team members have attended and presented contributions in Euro-VO, NVO other meetings and schools. VO subject was always present at Byurakan International Summer Schools (BISS) and Byurakan Summer Schools (BSS) for YSU students series since 2005, where a number of outstanding foreign lecturers have taught.

ArVO funded projects include several ANSEF grants (PS-450, PS-702 and PS 2968) and CRDF grant ARP1-2849-YE-06 in 2007-2010 “*Digitized First Byurakan Survey and Armenian Virtual Observatory*”, as well as the abovementioned ISTC grants in collaboration with IIAP ISTC A-1451 “*Development of Scientific Computing Grid on the Base of Armcluster for South Caucasian Region*” and ISTC A-1606 “*Development of Armenian-Georgian Grid Infrastructure and applications in the fields of high energy physics, astrophysics and quantum physics*”.

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YERVANT TERZIAN'S NASA LIFETIME ACHIEVEMENT AWARD



Prof. Terzian, the **David C. Duncan Professor in the Physical Sciences**, Department of Astronomy, Cornell University, was awarded to NASA Lifetime Achievement Award. He is one of the prominent modern astronomers, known in the fields of physics of the interstellar medium, planetary nebulae, galaxies, radio astronomy, and others. He is one of the **ArAS Co-Presidents** and the **Chairman of the Research Council of ANSEF**.

Yervant Terzian was born on February 9, 1939, in Alexandria, Egypt. His father was an Armenian and his mother, a Greek; hence, having **Armenian-Greek origin, Terzian is considered both as a great Armenian and Greek astronomer**. He finished the Kalousdian Armenian School in Cairo, then studied at the American University also in Cairo, and in 1960, he received the B.Sc. from the Physics/Mathematics Department of this University. Then he moved to the USA and in 1963 he received his M.Sc. and later on, in **1965, his Ph.D. degrees in Astronomy from the Indiana University**.

Since 1965, Terzian's research and teaching is connected to the Cornell University, Ithaca, NY. In 1965-1967, he was a research associate at the Arecibo Observatory, Puerto Rico; in 1967-1972: Assistant Professor of Astronomy; in 1968-1974: Assistant Director of the Center for Radiophysics and Space Research of the same University; in 1972-1977: Associate Professor of Astronomy; in 1973-1974: Visiting Professor of Astronomy at the University of Montreal, Canada; in 1974 (Feb-July): Visiting Professor of Astronomy at the University of Thessaloniki, Greece; in 1974-1979: Graduate Faculty Representative, Astronomy and Space Sciences, Cornell University; and since 1977 he is **Professor of Astronomy at Cornell University**.

Prof. Terzian's scientific fields are quite broad: from planetary nebulae (PNe) and pulsars to galaxy pairs and quasars. His studies have been carried out mainly in radio, however many papers are devoted to IR, optical, and UV observations as well. Among his **largest studies and most important results** one would mention:

1965-1988, Radio observations of PNe (*together with a few other colleagues*). Observations at various radio wavelengths were carried out, as well as radio spectra were taken. Radio recombination lines from PNe were studied. 13 papers were published in *Astrophysical Journal (ApJ)*, *Astronomical Journal (AJ)*, *Astronomy & Astrophysics (A&A)*, and other journals.

1965-1994, Radio observations of Galactic emission nebula / HII regions (*with a few other colleagues*). Study of the electron temperatures of the Orion Nebula and some other Galactic nebulae. High resolution observations of fine structures, etc. 25 papers were published in *ApJ*, *AJ*, *A&A*, *Astrophysics & Space Science (ApSS)*, *Publications of the Astronomical Society of the Pacific (PASP)*, and *Vistas in Astronomy*.

1967-1986, Study of the radio emission of normal spiral galaxies, including radio observations of M31 and M33 (*with a few other colleagues, including H.M. Tovmassian*). 10 publications in *ApJ*, *AJ*, and *PASP*.

1969-1995, Radio observations and studies of pulsars (*with K. Davidson and other colleagues*). An analysis of the pulsar dispersion measures was made to investigate the distribution of pulsar and interstellar electron densities. Another paper (*together with D.M. Sedrakian, et al.*) was devoted to the superfluid core rotation in pulsars. 6 papers were published in *ApJ*, *AJ*, *A&A*, *ApSS*, and *Nature*.

1969-1997, Optical studies of PNe (*with B. Balick, A.R. Hajian, S.E. Schneider, et al.*). Many-sided optical studies of PNe, including their reddening curves, radial velocities, etc. 10 papers were published in *ApJ*, *AJ*, *A&A*, and *ApSS*.

1970-1990, Study of the neutral hydrogen (HI) and molecular clouds (*with J.M. Dickey, E.E. Salpeter, H.E. Payne, S.W.J. Colgan, et al.*). Radio observations of interstellar and intergalactic HI, CO, and OH clouds. 22 publications in *ApJ*, *ApJ Supplement Series (ApJSS)*, *AJ*, *A&A*, *PASP*, and *Radio Science*.

- 1972, Expected infrared spectra from planetary nebulae** (with *D.B. Sanders*). Based on the analysis of the radiation of PNe, their expected IR spectra were discussed. A paper was published in *AJ*.
- 1973, Optical Atlas of Galactic Supernova Remnants** (with *S. van den Bergh and A.P. Marscher*). Published in *ApJSS* (vol. 26, p. 19).
- 1974, Detection of radio emission from some Markarian galaxies** at 430 MHz (with *H.M. Tovmassian*). The results were published in *PASP*.
- 1974-1984, High resolution radio observations of PNe** (with *B. Balick and others*). Radio synthesis and Arecibo interferometer observations were carried out for search for sub-arcsecond structure in compact PNe. Three papers were published in *ApJ* and *AJ*.
- 1977-1979, Radio observations of globular clusters** and radio sources in the direction of globular clusters (with a few other colleagues). Two papers were published in *AJ*.
- 1979-2000, Study of galaxy pairs** (with *T.E. Nordgren, J.N. Chengalur, E.E. Salpeter, et al.*). HI observations; the distribution of galaxy pair redshifts; close and wide galaxy pairs in the North and South. Compilation of the 1 Mpc Galaxy Pair Sample in low-density regions. 8 papers published in *ApJ*, *ApJSS*, *ApSS*, and *Journal of the Royal Astronomical Society of Canada (JRASC)*.
- 1981-1982, VLBI observations of galactic nuclei** (with *D.L. Jones and R.A. Sramek*). 6cm VLBI observations of 15 galactic nuclei. Spectra of compact radio sources in the galactic nuclei. 2 publications in *ApJ*.
- 1982, Detection of radio emission from cometary nebulae** (with *K.C. Turner*). An investigation of cometary nebulae at radio wavelengths was conducted: 48 objects in the declination range of the Arecibo telescope were observed at 12cm and 21cm, and 10 of them showed detectable radio emission. The results were published in *ApJ*.
- 1986-2004, Search and study of OH/IR stars** (with *B.M. Lewis, J. Eder, et al.*). The Arecibo OH survey (1612 MHz observations) of 571 OH/IR stars identified by IRAS colors; 132 were detected. 2MASS counterparts for OH/IR stars were identified. 12 publications in *ApJ*, *ApJSS*, *ApSS*, *Monthly Notices of the Royal Astronomical Society (MNRAS)*, *PASP*, and *Nature*.
- 1988, Detection of continuum radio emission from Virgo galaxies** (with *K.C. Turner and G. Helou*). Single-antenna measurements of radio emission from 120 galaxies in the Virgo cluster at 2380 MHz, as well as interferometric measurements at the same frequency for 48 galaxies with $\square 1 \square$ resolution. It was found that the disk emission dominates in most cases. Indications that the flux concentration was greater in E/S0 than in S. The results were published in *PASP*.
- 1991, Two-component velocity system model of PNe** (with *G.A. Gurzadyan*). Phenomena were discussed in the behavior of the expansion velocities of PNe and a possible explanation was suggested, namely that PNe originate from two distinct types of progenitor stars. A paper was published in *AJ*.
- 1993-1996, Study of the dynamics of binary galaxies** (with *J.N. Chengalur and E.E. Salpeter*). Study of high resolution HI synthesis data (radio maps) and CCD images of wide and close pairs; galaxy pairs, redshift catalogs, and the cosmic peculiar velocity. 4 papers published in *ApJ* and *AJ*.
- 1993-1998, Fast, low-ionization emission regions (FLIERS) and other microstructures in PNe** (with *B. Balick, A.R. Hajian, M. Perinotto, et al.*). High spatial resolution Palomar Observatory 5m telescope long-slit observations and Hubble Space Telescope (HST) Wide Field Planetary Camera 2 imaging studies of "FLIERS" and other microstructures in a number of bright PNe were performed. Four papers were published in *ApJ* and *AJ*.
- 1993-2002, Planetary nebulae expansion distances** (with *A.R. Hajian, C. Bignell, et al.*). VLA 6cm two-epoch observations were carried out to measure accurate expansion parallax distances to planetary nebulae. On the other hand, HST measurements were used for the same purpose. Six papers were published in *AJ* and *PASP*.
- 1995-2006, The morphology and kinematics of Markarian galaxies with double and multiple nuclei** (with *T.E. Nordgren, G. Helou, J.N. Chengalur, E.Ye. Khachikian, et al.*). Basic data and preliminary analysis for 16 Markarian galaxies observed with the Palomar Observatory 5m telescopes were given. 2 publications in *ApJSS* and *MNRAS*.
- 1999, The sample of IR planetary nebulae in the NVSS** (with *J.J. Condon and D.L. Kaplan*). A cross-correlation of IRAS sources having colors characteristic of PNe with the 1.4 GHz NRAO VLA Sky Survey sources was made and 454 sources were selected as candidate PNe. 122 new PNe were revealed among them. The sample was published in the *ApJSS*.
- 2007, Atlas of [NII] and [OIII] Images and Spectra of PNe** (with *A.R. Hajian, et al.*). An atlas of HST images and ground-based, long-slit, narrowband spectra centered on the [NII] 6584A and the [OIII] 5007A

lines. Basic parameters for the subsample of PNe that present ellipsoidal appearances and regular kinematic patterns were derived. The Atlas was published in *ApJSS*.

Other studies related to radio observations of extragalactic sources (quasars and radiogalaxies), X-ray sources, comets, evolution of the radio luminosities of the Tycho and Kepler SNR, etc.

In 1968, Terzian was appointed the Vice-Chairman, and in 1979, the **Chairman of the Department of Astronomy at the Cornell University** and headed this large (one of the largest and most important in the USA) department for 20 years! In 1979-80 and 1992-93 he was the Acting Director of the Center for Radiophysics and Space Research of the Cornell University.

Since 1986, Terzian is Professor in Graduate Field of History and Philosophy of Science and Technology, and since 1991, in Field of Science and Technology Studies, Cornell University. In 1988-1999 he was the Director of Pew Undergraduate Science Education Program, New York State Cluster of Colleges and Universities; in 1990-1999: James A. Weeks Professor of Physical Sciences, Cornell University. Since 1996, he is the **Director of NASA's New York State Space Grant Program** (Cornell University) to enhance science education. In 1999-2000, he was a Visiting Professor, University of California, San Diego, and since 1999, **David C. Duncan Professor in the Physical Sciences, Cornell University**.

In 2002 Terzian was elected the **Chairman of the US Consortium of Universities and Institutes** to construct the **Square Kilometer Array (SKA)** giant radio telescope. Since 2001, he is the **Chairman of the Research Council of the Armenian National Science and Education Fund (ANSEF)**.

Prof. Terzian has been the Associate Editor and the Scientific Editor of the *Astrophysical Journal* (1989-1999), one of the leading astronomical journals in the world. In 1982-1992 he was a member of the Editorial Advisory Board of *The Encyclopedia of Astronomy and Astrophysics*. Since 2000, Terzian is a member of the Editorial Board of *Astrofizika*.

Prof. Terzian is **member** of a number of **professional societies and organizations**: International Astronomical Union (IAU, 1967), International Union of Radio Science, American Astronomical Society (AAS), Armenian Astronomical Society (ArAS, 2001), Hellenic Astronomical Society (HelAS), Sigma Xi, Scientific Research Society, Astronomical Society of New York, Historical Astronomy Division, Society for Scientific Exploration, American Association for the Advancement of Science (Fellow, 2001). In 1990, he was elected **Foreign Member of the Armenian National Academy of Sciences (NAS)**, and in 2002, **Co-President of the Armenian Astronomical Society (ArAS)**.

Terzian's **organizational activities** have been rather large: he has been chairman, vice-chairman, or member of numerous committees and commissions of the IAU Working Groups, US National Academy of Sciences, New York Astronomical Society, NASA, NSF, etc. and Scientific Organizing Committees (SOC) of a number of international (including IAU) symposia and conferences. He was the Chairman of the IAU Working Groups on *Planetary Nebulae* (1985-1994) and on *Astronomy from the Moon* (1993-1999).

For his research achievements and teaching merits *Prof.* Terzian has been awarded numerous **titles, degrees, awards, medals, and honors**, among which are: **Honorary Doctor of Science** degrees from the University of Indiana, USA (1989), the Yerevan State University, Armenia (1994), the University of Thessaloniki, Greece (1997), and the Union College, New York, USA (1999); the Clark Distinguished Award for Excellence in Teaching from Cornell University (1984); the Distinguished Alumni Award from the American University in Cairo (2004); the Dicran H. Kabakjian Award for Outstanding Achievement in Science, North American Armenian Student Association, Boston, MA (1985); Gold Medal, Ministry of Science and Education, Armenia (2008); and Viktor Ambartsumian Medal, Armenian National Academy of Sciences (2008).

Prof. Terzian is an author or co-author of **232 scientific publications** and the **editor of 6 books**, including "Carl Sagan's Universe" (1997). Out of these publications 164 are in refereed scientific journals, including papers in *Nature*, where only outstanding results are being accepted. According to the ADS database, during 1962-2008, there are altogether 315 publications by Terzian, many still possibly being missed.

We would like to mention two of the most important modern activities by *Prof. Terzian* that strongly support the development of the Armenian astronomy and science in general: his role in the creation and activities of ANSEF and ArAS.

The **Armenian National Science and Education Fund (ANSEF)** was established in 1999, in New York City, by a group of Armenian academic and other intellectuals, Yervant Terzian among them. ANSEF provides peer reviewed research awards to support scientific, technological and scholarly research. Since the beginning, **ANSEF Research Council is chaired by Prof. Terzian**. During 2001-2008, grants to about 200 projects have been awarded, USD 5000 to each. Altogether, more than 500 senior and junior scientists and scholars have benefited from this support. In the field of astronomy and astrophysics, ANSEF has supported 24 projects involving more than 60 scientists from BAO and Yerevan State University.

The **Armenian Astronomical Society (ArAS)** also was established in 1999, however officially registered in 2001. Since the beginning, *Prof. Terzian* was one of the initiators and active members of ArAS. In 2002, during the first annual meeting, there was a decision to have three Co-Presidents; *Prof. Terzian* was elected one of them and since then is an **ArAS Co-President**. He strongly supports the existence and activities of the Society and plays an important role in contacts between astronomers living in Armenia and abroad. In 2004, Terzian established the ArAS Annual Prize for Young Astronomers and since then sponsors it. Fourteen young scientists have received this prize, which we could call "*Yervant Terzian prize*".



MARIETTA GYULZADYAN WAS AWARDED GOLD MEDAL OF RA MINISTRY of EDUCATION and SCIENCE



Dr. Marietta Gyulzadyan, BAO Research Associate and teacher at Yerevan Physical-Mathematical high school after A. Shahinyan, was awarded a Gold Medal of RA Ministry of Education and Science for her great contribution in the achievements of Armenian pupils at International Astronomical Olympiads during 10 years and her continuous efforts in education of young generation in Armenia.

Marietta Vazgen Gyulzadyan was born on 13 December 1956 in Shamlugh, Toumanian District, Armenia. She graduated from the Department of Astrophysics of Yerevan State University (YSU) in 1978 and in the same year started working at BAO. Since 1990 M. Gyulzadyan was a Junior Research Associate, and since 2013 she is a Research Associate. She defended PhD thesis on Second Byurakan Survey (SBS) galaxies in 2013. Her research is devoted to various studies of extragalactic objects, Active Galactic Nuclei (AGN), UV-excess Galaxies (UVG), IRAS Galaxies, Starburst (SB) Galaxies, Clusters of Galaxies, and particularly, SBS galaxies. She has published more than 20 papers in *Astrofizika/Astrophysics* and other journals and conference proceedings, and more than 10 pedagogical materials. Her most important publication is the *Optical Database of 1676 SBS galaxies*, which is also included in VizieR as on-line data catalog VII/264. Since 2015, Marietta is an Executing Team Member of BAO Plate Archive Project. She lectures at Yerevan Physical-Mathematical high school after A. Shahinian, attached to YSU and has contributed significantly in preparation of Armenian pupils for astronomical Olympiads. Marietta is a member of ArAS since July 1999, the very beginning of its foundation. She is member of IAU since 2015, Jury member of International Astronomical Olympiads (IAO) since 2006, Jury member of International Olympiad on Astronomy and Astrophysics (IOAA) since 2012, she is the Armenian Representative of Galileo Teachers Training Program (GTTP) and she is one of the Galileo Teachers in Armenia.



Dr. Gyulzadyan's was the leader of Armenian team at IAO since 2006 and IOAA since 2013. Her achievements may be summarized as follows:

2007 IAO-XII – 1 Bronze medal (*Hrant Gharibyan*)

2008 IAO-XIII – 1 Gold medal (*Hayk Saribekyan*)

2009 IAO-XIV – 2 Gold medals (*Hayk Tepanyan and Hayk Hakobyan*)

2010 IAO-XV – 3 Bronze medals (*Aram Mkrtchyan, Virab Gevorgyan and Vahan Aslanyan*)

2011 IAO-XVI – 1 Gold (*Levon Stepanyan*) and 3 Bronze medals (*Virab Gevorgyan, Karen Hambartsumyan and Vardges Mambreyan*)

2012 IAO-XVII – 1 Gold (*Gevorg Martirosyan*), 1 Silver (*Arsen Vasilyan*) and 2 Bronze medals (*Vardges Mambreyan and Siranush Babakhanova*)

2013 IAO-XVIII – 4 Bronze medals (*Vardges Mambreyan, Arsen Vasilyan, Hrant Topchyan and Hayk Soghomonyan*)

2014 IOAA-VIII – 2 Silver (*Arsen Vasilyan and Gevorg Martirosyan*) and 2 Bronze medals (*Edgar Vardanyan and Vardges Mambreyan*)

2014 IAO-XIX – 1 Gold medal (*Edgar Vardanyan*)

2015 IOAA-IX – 3 Bronze medals (*Hrant Topchyan, Ara Mambreyan, Edgar Vardanyan*)

2015 IAO-XX – 2 Bronze medals (*Ara Mambreyan, Edgar Vardanyan*)



As a result, Armenian teams led by Marietta during 2006-2015 have won 6 Gold, 3 Silver and 20 Bronze medals. This is one of the best results among all countries at International Astronomical Olympiads. And most of the students were Marietta's own ones from Phys.-Math. School.

We congratulate Marietta and wish her further success and great achievement.

Areg Mickaelian

ArAS ANNUAL PRIZE FOR YOUNG ASTRONOMERS 2015



December 1 is the standard deadline for nominations for **ArAS Annual Prize for Young Astronomers (Yervant Terzian Prize) 2015**. However, to allow a few days after release of this Newsletter, this year we have **extended the deadline to December 5**. No nominations will be accepted after that date.

The prize will be awarded to a young scientist under 35 working in astronomy or related field and showing significant results in research and/or other scientific activities connected anyhow with the Armenian astronomy. **Nominations** may be made by ArAS members or any research organization from Armenia or elsewhere and should be sent to one of the ArAS Co-Presidents (Haik Harutyunian, Areg Mickaelian or Yervant Terzian). Please make sure that a copy is sent to Areg Mickaelian (aregmick@yahoo.com).

Nominations should include personal data of the nominee (first name, surname, affiliation, position, education, degree, birthdate, e-mail address, personal homepage if available) and a brief description of his/her achievements during 2015, including:

- research and other projects, where the nominee is involved
- scientific results during 2015 (up to 1 page),
- letter from the supervisor describing the personal contribution of the nominee,
- published, accepted and submitted papers (refereed journal papers, electronic catalogues, papers in proceedings of meetings, books, reviews, etc.),
- participation in meetings and schools,
- presented talks, seminars, posters or given lectures (at meetings/schools)
- scientific missions,
- honours, awards and research grants,
- membership,
- teaching activity,
- organizational activity,
- any other activities, whatever is considered by the nominee to be important.

At least one refereed publication is required to qualify for the Prize. Preference will be given to nominees having publications in journals with higher impact factors (IF), with less co-authors and papers with the nominee as the first co-author, as well as the nominee's personal contribution stated by the supervisor will be rather important. Nominations will be discussed and the winner(s) will be named by the ArAS Council (Haik Harutyunian, Tigran Magakian, Areg Mickaelian, Elena Nikoghosyan and Yervant Terzian). The winner will be announced in the last issue of ArAS Newsletter (#88) at the end of 2015. A **diploma** and sum of **USD 500** will be awarded to the winner.

The Prize was established in 2004 and is being sponsored by ArAS Co-President **Prof. Yervant Terzian** (Cornell University, USA). Since 2009 the Prize is named after Yervant Terzian. During 2004-2014, 12 young astronomers have been awarded the Prize, including Lusine Sargsyan (twice), Parandzem Sinamyman and Vardan Adibekyan (twice, one sharing). Three winners were from foreign countries: Igor Chilingarian (France, 2007), Vardan Adibekyan (Portugal, 2012) and Avet Harutyunian (Spain, 2013).

Previous ArAS Annual Prize (Yervant Terzian Prize) Winners

2014	Gurgen PARONYAN (BAO)
2013	Hayk ABRAHAMYAN (BAO) and Avet HARUTYUNYAN (TNG-IAC, Spain)
2012	Vardan ADIBEKYAN (CAUP, Portugal)
2011	Marine AVTANDILYAN (ASPU)
2010	Parandzem SINAMYAN (BAO)
2009	Lusine SARGSYAN (BAO)
2008	Vardan ADIBEKYAN (YSU) and Artur HAKOBYAN (BAO)
2007	Igor CHILINGARIAN (OBSPM, France)
2006	Lilit HOVHANNISYAN (BAO) and Parandzem SINAMYAN (BAO)
2005	Artak HARUTYUNYAN (BAO) and Elena HOVHANNESIAN (BAO)
2004	Lusine SARGSYAN (BAO)

ESO-ARMENIA DISCUSSION



In June 2014, **Byurakan Astrophysical Observatory International Science Advisory Committee (BAO ISAC)** created by NAS RA visited Armenia and investigated the current state of BAO. ISAC had a number of meetings with NAS RA President *Prof. Radik Martirosyan*, BAO Director *Dr. Haik Harutyunian*, BAO researchers, visited BAO telescopes and other sites and at the end of 2014 submitted an extended report to NAS RA President. One of the main recommendations was to join ESO to be integrated in European astronomy and benefit from ESO observing facilities.



A bird's-eye view of ESO Headquarters and ESO Council meetings room in Garching, near Munich, Germany.

According to these recommendations and on behalf of NAS RA President, BAO Deputy Director on Foreign Affairs *Dr. Areg Mickaelian* started negotiations with ESO administration, namely Director General *Prof. Tim de Zeeuw* and Director for Science *Prof. Rob Ivison*. A visit of *Prof. Radik Martirosyan* and *Dr. Areg Mickaelian* was planned to ESO Headquarters in Garching, Germany for 5 November 2015.



From left to right: Tim de Zeeuw, Laura Comendador Frutos, Radik Martirosyan and Areg Mickaelian.

On 5 November 2015, Areg Mickaelian visited ESO, while Radik Martirosyan personally could not travel and participated in the meeting by Skype telecon. On behalf of ESO, *Prof. Tim de Zeeuw* and the Head of Director General Cabinet *Mrs. Laura Comendador Frutos* took part. The meeting agenda included presentations by both parts (ESO and Armenia), discussion and acquaintance to ESO Headquarters. *Laura Comendador Frutos* presented ESO foundation, organization, facilities and practical matters related to acceptance of new member states. It was stated that countries (not individual institutions) may become ESO members, so in case of Armenia, governmental decision should be made.



Map of ESO member states and ESO Chile sites.

Areg Mickaelian made a presentation about Armenian astronomy, including Viktor Ambartsumian, BAO (short history and achievements, scientific staff, observing and other facilities, current projects, international collaboration, meetings and other activities), other astronomy related Armenian institutions (Physics and Radiophysics departments at YSU, related departments at YerPhI (A. Alikhanyan National Laboratory), Center for Cosmology and Astrophysics, and

ICRANet), Markarian Survey and DFBS, Armenian Virtual Observatory (ArVO), Armenian Astronomical Society (ArAS), *Astrofizika/Astrophysics* journal, Viktor Ambartsumian International Science Prize, and recently established IAU South West Asian Regional Office of Astronomy for Development (SWA ROAD). ESO representatives were impressed by activities in Armenian astronomy. The presentation files were exchanged and are now available at both parts.

ESO telescopes					
Name	Short	Size	Type	Location	Year
ESO 3.6 m telescope – <i>hosting HARPS</i>	ESO 3.6m	3.57 m	optical and infrared	La Silla	1977
MPG/ESO 2.2 m telescope	MPG	2.20 m	optical and infrared	La Silla	1984
New Technology Telescope	NTT	3.58 m	optical and infrared	La Silla	1989
Very Large Telescope	VLT	4 × 8.2 m 4 × 1.8 m	optical to mid-infrared, array	Paranal	1998
Atacama Pathfinder Experiment	APEX	12 m	millimetre-/submillimetre-wavelength	Chajnantor	2005
Visible and Infrared Survey Telescope for Astronomy	VISTA	4.1 m	near-infrared, survey	Paranal	2009
VLT Survey Telescope	VST	2.6 m	optical, survey	Paranal	2011
Atacama Large Millimeter/submillimeter Array ^[A]	ALMA	50 × 12 m 12 × 7 m 4 × 12 m ^[29]	millimetre-/submillimetre-wavelength interferometer array	Chajnantor	2011
European Extremely Large Telescope	E-ELT	39.3 m	optical to mid-infrared	Cerro Armazones ^[23]	2024

^A ALMA is a partnership among Europe, the United States, Canada, East Asia and the Republic of Chile.

The discussion was about possible collaboration between ESO and Armenia and Armenia's planned membership in ESO. Forms of collaboration may be organization of joint meetings and schools, mutual visits, study of technical details of BAO telescopes for possible exchange of equipment for joint observing programs. It was agreed that Armenia would participate in ESO – Eastern Europe meeting to be held in Prague (or possibly, in Vienna) in 2016 organized by Jan Palous, the person in charge for collaboration with Eastern European countries. On the other hand, Radik Martirosyan invited Tim de Zeeuw to visit Armenia in 2016. Areg Mickaelian suggested that Tim de Zeeuw (and other ESO staff members) could participate in the international symposium dedicated to BAO 70th anniversary to be held in September 2016 in Byurakan. A joint ESO-BAO summer school may be organized following the first such school on 22-28 September 1987 in Byurakan, Armenia “*Observations with Large Telescopes*” (www.aras.am/Meetings/ESOburakanschool.html) organized by Viktor Ambartsumian and ESO leaders Lodewijk Woltjier (then ESO Director General), Richard West, Jorge Melnick, Massimo Tarenghi, Sandro D’Odorico, Alan Moorwood and others. Areg Mickaelian was invited to visit ESO Chile sites to get better acquaintance to ESO facilities. Tim de Zeeuw suggested that Armenian astronomers could more actively use ESO science archive for further research. It was stated that Armenian officials would study the practical matters related to Armenia’s membership in ESO.



ESO observing sites and telescopes in Chile

Summary of future actions:

- **Visit of ESO Director General Prof. Tim de Zeeuw** (and possibly other ESO Officials) to **Armenia** (2016)
- **Dr. Areg Mickaelian's** (and possibly other BAO Officials) participation in **ESO – Eastern Europe meeting** (Prague or Vienna, 2016)
- ESO representatives participation in **international symposium dedicated to BAO's 70th anniversary** (Sep 2016, Byurakan)
- **Dr. Areg Mickaelian's** (and possibly other BAO scientists) **visit to Chile to ESO's facilities** (2016, La Silla, Paranal, Chajnantor)
- Organization of a joint **ESO-BAO summer school in Byurakan** (2016)
- Study of **technical details of BAO telescopes for possible exchange of equipment** for joint observing programs
- Using **ESO Science Archive** by Armenian astronomers
- Study by Armenian officials of practical matters related to **Armenia's membership in ESO**

Areg Mickaelian

ARMENIAN ASTRONOMERS VISIT TO XINJIANG ASTRONOMICAL OBSERVATORY

On October 24-31st, Senior Research Associate of Byurakan Astrophysical Observatory Dr. Ruben Andreasyan and Senior Assistant Hasmik Andreasyan were invited to the Xinjiang Astronomical Observatory (XAO) of Chinese Academy of Sciences by Prof. Xiang Liu.



The aim of their visit was to discuss possible collaboration and joint observations of variable sources on Urumqi 26m radio telescope in XAO of China and optical telescopes in Byurakan Astrophysical Observatory. During the visit both of the Armenian representatives had seminar in XAO. Dr. Ruben Andreasyan had a 20 min. talk presenting Byurakan Observatory and its observational possibilities. He had also 40 min. talk introducing his field of research. Hasmik Andreasyan had a 20 min. talk on the topic “Galactic distribution of normal radio pulsars”. They were also in the seminar of working group of Prof. Xiang Liu, where his students presented their field of investigation.

For the beginning of collaboration they decided to begin test simultaneous observations of some objects in XAO and BAO telescopes, and depending on the results, to present a plan of a long-term collaboration.



Hasmik Andreasyan

SEAC ANNUAL MEETING 2015



The European Society for Astronomy in Culture (SEAC; web site <http://www.archeoastronomy.org/>) Annual Meeting “Astronomy in Past and Present Cultures” was held on November 9-13, 2015 in Rome, Italy. SEAC is a professional association of scientists working in the field of Cultural Astronomy, including the interdisciplinary fields of Archaeoastronomy and Ethnoastronomy. In principle, past cultures should have been interested in all astronomical phenomena visible to the naked eye. However, it is obvious that some of these phenomena are so evident and linked to vital factors that it is difficult to believe they were ignored in any cultural context. The term “Archaeoastronomy” is currently used to define the studies concerning “what peoples throughout history and prehistory have made of the phenomena in the sky, how they used these phenomena and what role they played in their cultures” (Sinclair 2006), while Ethnoastronomy concerns the study of the influence of celestial phenomena on present day population folklore. To date, Archaeoastronomy, Ethnoastronomy and Historical Astronomy (the studies dedicated to recovering data of astrophysical interest from historical documents of pre-telescopic epoch, i.e. before the 17th century AD) are grouped as “Cultural Astronomy”. However, researchers in nearby fields of science like History of Astronomy and Mythology are also welcomed in SEAC conferences. Furthermore, the present day cultures are also strongly influenced by astronomy: we will be glad to discuss also about these relationships.

At “Astronomy in Past and Present Cultures” meeting the following topics were discussed:

- Problems and Methods of Cultural Astronomy
- Astronomy in Extra-European Cultures
- Astronomy in Ancient Near East (Mesopotamia, Persia, Levant, Turkey) and Egypt, from the origins to 395 CE
- Cultural Astronomy in Ancient Greece
- Cultural Astronomy in Ancient Italy and in Roman Empire
- Cultural Astronomy in Ancient Italy and in Roman Empire
- Cultural Astronomy in Ancient Iberian Peninsula and Canary Islands
- The Sky Bear
- Cultural Astronomy in Ancient Northern Europe and British Islands
- Cultural Astronomy in Ancient Eastern Europe
- Cultural Astronomy in Christian Churches
- Astronomy in Medieval texts
- Cultural Astronomy in Renaissance and Modern Epoch
- Cultural Astronomy in Contemporary Epoch

From Armenia, the Deputy Director of BAO, SEAC member Dr. Areg Mickaelian and Ph.D. student Sona Farmanyan took part in this meeting. A.M. Mickaelian gave an oral talk on “Armenian Archaeoastronomy and Astronomy in Culture” and S.V. Farmanyan gave an oral talk on “Ancient Cosmology in Armenian Highland”. At SEAC General Assembly S. Farmanyan was also elected as SEAC member. Another SEAC Armenian member is Elma Parsamian.

Sona Farmanyan

RELEASE OF ASTROPHYSICS DECEMBER ISSUE



NAS RA journal “Astrophysics” (Russian translation of “Astrofizika”) Vol. 58, Issue 3 was released in November.

Following papers are included:

Polarization of Radiation and Basic Parameters of the Circumnuclear Region of Active Galactic Nuclei

Yu. N. Gnedin, M. Yu. Piotrovich, N. A. Silant’ev, T. M. Natsvlishvili...

Extending the H α Survey for the Local Volume Galaxies

I. D. Karachentsev, S. S. Kaisin, E. I. Kaisina

The Rotation of Groups of Galaxies

H. M. Tovmassian

Multiple Star Systems in the Young Cluster IRAS 05137+3919

E. H. Nikoghosyan, H. A. Harutyunian, N. M. Azatyan

Statistical Analysis of Stars with H α Emission in the Cluster IC 348

E. H. Nikoghosyan, A. V. Vardanyan, K. G. Khachatryan

Oxygen-Rich Cool Stars in the Cepheus Region. New Observations. III

G. V. Petrosyan, C. Rossi, S. Gaudenzi, R. Nesci

Investigation of Rare-Earth Elements in the Atmosphere of the roAp Star HD 134214: Nd II, Nd III, and Gd II Lines

N. G. Mykhailytskaya

Some Astrometric and Kinematic Characteristics of the M67 Open Cluster

W. H. Elsanhoury

Generation and Distribution of a Magnetic Field in Superconducting Strange Stars

D. M. Sedrakian, M. V. Hayrapetyan, D. S. Baghdasaryan

Evolution of Angular Momentum Distribution in Exoplanet Systems

P. A. Tarakanov, A. S. Artamonov

Spectral Linewidth Variations in the Solar Chromosphere

D. Khutsishvili, E. Khutsishvili, T. Kvernadze, V. Kulidzanishvili...

Investigation of Solar Rotation Using Coronal Holes

D. R. Japaridze, S. R. Bagashvili, B. M. Shergelasvili, B. B. Chargeishvili

RELEASE OF NRAO NEWSLETTER



35 Years of Constraints on Thermonuclear Supernova Progenitors with the VLA

Today, the progenitors of Type Ia Supernovae (SNe) and their lower-luminosity thermonuclear cousins remain shrouded in mystery. [Read more...](#)



ALMA Program News

ALMA began Cycle 3 observations as scheduled on 15 October with the array in its long baseline, C36-8 configuration. Baselines in this configuration span 267 m to 12.645 km, providing a beam size of ~ 0.06 arcsec at 100 GHz [Read more...](#)



Director for the NRAO Office of Diversity & Inclusion

I am pleased to announce that Lyndele von Schill has been selected as the Director for the NRAO Office of Diversity & Inclusion. [Read more...](#)



Robert L. Brown Outstanding Doctoral Dissertation Award

Applications for the 2015 Robert L. Brown Outstanding Doctoral Dissertation Award should be submitted to RLBrownAward@nrao.edu by 31 January 2016. [Read more...](#)



NRAO Summer Student Presentation at NSF

NRAO Research Experiences for Undergraduates (REU) student Elizabeth Nance (St Mary's College of Maryland) was one of four astronomy students invited to present her research at the REU Symposium in Arlington, VA in October. [Read more...](#)



NRAO Acknowledgement in Scientific Publications

NRAO is audited annually by the National Science Foundation (NSF) regarding the inclusion of the official, one-sentence Observatory acknowledgement in scientific papers [Read more...](#)



GBT & Cellphone RFI Mitigation

Due to recent changes in the way the U.S. Federal Communications Commission will handle licensing of cell phone transmitters, a more diligent approach to monitoring and mitigating any cellphone Radio Frequency Interference (RFI) must be undertaken [Read more...](#)



Celebrating the 140-Foot Telescope

On 13 October 2015, fifty years to the day after the dedication of the 140-foot Telescope on 13 October 1965, 70 retirees and friends and 80 current employees gathered [Read more...](#)



2014 NRAO Annual Report

The NRAO Annual Report for calendar year 2014 describes the year's science highlights and summarizes the numerous science, development, operations, and construction activities that were conducted across the Observatory from 1 January – 31 December 2014. [Read more...](#)

ESO OUTREACH COMMUNITY NEWSLETTER



Winners of Photo Nightscape Award 2015 Announced

10 November 2015: The outcome of the 2015 Photo Nightscape Award — organised by Ciel et Espace Photos — has been decided. Over 400 photographs and timelapses from more than 50 countries were submitted for ... [Read more](#)

Ceremony Marks Excellent Progress in Constructing ESO Supernova

29 October 2015: In recent months, the construction of the ESO Supernova Planetarium & Visitor Centre has made substantial progress and the remarkable architecture of the building has become clearly visible. To celebrate ... [Read more](#)



Listen to the Music of a Dying Star — The ALMA Music Box, currently on display in Japan, now available on iTunes

27 October 2015: Music from the ALMA Music Box — an audio artwork that plays melodies created from ALMA observations — is now available to be purchased in the iTunes store, on the compilation CD ... [Read more](#)

ESO Art & Science Residency Applications Open

21 October 2015: In partnership with the Art & Science Network, ESO invites interested artists to submit applications to be considered for a residency at one of its Chilean observatories. Conducted by Ars ... [Read more](#)



Winners of Third ESO Astronomy Camp Bursaries Announced

19 October 2015: Registration for secondary school students to attend the third ESO Astronomy Camp has now closed. More than 120 video applications were submitted and the winners of the bursaries offered by ... [Read more](#)

RELEASE IAU ASTRONOMY OUTREACH NEWSLETTER 2015 #16 & #17



In #16 Newsletter:

From the Editors

1. IAU National Outreach Contact Corner: News from Portugal
2. HighLIGHT of the Month: Skylight continues to amaze
3. CosmicLight around the world
4. The International School for Young Astronomers
5. Open Science Centre
6. NASA's 2015 Cassini Scientist for a Day essay competition
7. ALMA kids
8. The Martian
9. Upcoming meetings & global events around the world
10. Contributions to this newsletter

In #17 Newsletter:

From the Editors

1. IAU Office of Astronomy for Development (OAD) August–October newsletter is out!
2. Communicating Astronomy with the Public Conference 2016
3. IAU National Outreach Contact Corner: News from Spain
4. HighLIGHT of the Month: GalileoMobile back on the road
5. CosmicLight around the world
6. Fiat Physica
7. Menu of Outreach Opportunities for Science Education
8. Global for Local
9. Upcoming meetings & global events around the world
10. Contributions to this newsletter

RELEASE OF UNawe NEWSLETTER



Read about the latest Universe Awareness activities taking place around the world!



Call for Teachers: the Space Awareness MOOC

Enthusiastic teachers are invited to use their creativity and imagination to design space-related activities for students between 8 and 18 years old, in collaboration with experts of the Space Awareness project. The activities will be used in the Space Awareness MOOC (massive open online course) series.

Open Science Centre

Science and technology should be available to remote communities that don't have access to it. With this vision the Open Science Centre project was launched this week. The Open Science Centre (OSC) will be a learning and gathering space to inspire and engage local communities and thereby foster sustainable development.



23 Countries Represented at Universe Awareness International Workshop

65 educators, teachers and astronomers from 23 different countries participated in the Universe Awareness (UNawe) International Workshop, that took place from 5 – 9 October 2015 at Leiden Observatory and was part of the United Nation's World Space Week.

Alenush TERIAN (1920-2011) – 95

Prof. Alenush Terian was the **first Iranian female astronomer and physicist** and she was known as **Mother of Modern Iranian Astronomy**. She was born on 9 November 1920 to an Armenian family in Tehran. A. Terian graduated in 1947 from the Science Department of University of Tehran. She began her career in the physics laboratory of this University and was elected the Chief of laboratory operations in the same year. For continuing her studies, Terian left Iran

for France where in 1956 she obtained her doctorate in Atmospheric Physics from Sorbonne University. Upon this she returned to Iran and became Assistant Professor in thermodynamics at University of Tehran. Later she worked in Solar Physics in the then West Germany for a period of four months through a scholarship that was awarded by the German government to University of Tehran. In 1964 *Dr.* Terian became the first female Professor of Physics in Iran. In 1966, *Prof.* Terian became Member of the Geophysics Committee of University of Tehran. In 1969 she was elected the Chief of the Solar Physics studies at this University and began to work in the Solar Observatory of the Institute of Geophysics, of which she was one of the founders. She retired in 1979. *Prof.* Terian's 90th birthday celebration in Tehran was attended by a number of Iranian parliamentarians and over 100 Iranian Armenians. She passed away on 4 March 2011 in Tehran at the age of 91.

Romela SHAHBAZIAN (1925-2012) – 90

Dr. Shahbazian was one of Byurakan astronomers after whom celestial objects have been named; she is well-known for **Shahbazian compact groups of compact galaxies**. Romela Karapet Shahbazian was born on 18 November 1925. She worked at BAO for 42 years, from 1953 until 1995. In 1970 Shahbazian defended her PhD thesis under the supervision of V.A. Ambartsumian. Her fields of interest were extragalactic studies: photometry of galaxies, superassociations in galaxies and extragalactic supernovae, groups of galaxies and their morphology. Shahbazian's most important contribution was the discovery of compact groups of compact galaxies (discovered in 1957-1974 and published in 10 lists in 1973-1979 by R.K. Shahbazian, M.B. Petrosian, F.W. Baier and H. Tiersch, altogether 377 objects), named Shahbazian groups. The Catalog of the Compact groups of compact galaxies was included in Vizier in 1996 (catalog VII/89B). In 1957-1958, she discovered together with V.A. Ambartsumian blue outbursts and companions near elliptical galaxies supporting Ambartsumian's hypothesis of activity of galactic nuclei. In 1963, she discovered "superassociations" in distant galaxies, large blue formations, later found to be emission-line objects and called HII regions. A proof of young age of these galaxies was given (together with V.A. Ambartsumian, S.G. Iskudarian, and K.A. Sahakian). In 1960s-1990s, she searched and studied extragalactic Supernovae (SNe); dozens of new SNe were discovered, as well as 3 SNe in one galaxy during 6 years (together with S.G. Iskudarian, R.G. Mnatsakanian, and A.R. Petrosian). In total, Shahbazian has published more than 50 papers. She was a member of IAU. She passed away on 12 April 2012 in Yerevan, at the age of 87.



*BAO senior generation female astronomers. From left to right:
Romela Shahbazian, Nina Ivanova, Elza Hovhannesian, Elma Parsamian,
Renata Mnatsakanian, Sveta Arakelian and Karine Sahakian.*

Renata MNATSAKANIAN – 85

Renata Gegham Mnatsakanian was born on 18 November 1930 in Tbilisi. She graduated from the Yerevan State University (LSU) in 1953. Since 1957 she worked at BAO, first as a laboratory assistant, then in 1958-1959 as an engineer, and since 1960 as a junior research associate. In 1975 she was appointed as the Head of the Informatics Department attached to the BAO library. Mnatsakanian has some 20 research papers published in 1965-1984 on Supernovae, blue stars in clusters, blue galaxies, and galaxy clusters. Later, in 1987, she moved to the Institute of Radio Measurements in Orgov to work with *Prof.* Paris Herouni.

Elza HOVHANNESIAN (1935-1994) – 80

Elza Yakov Hovhannesian was born on 22 November 1935 in Leningrad (St. Petersburg). She graduated from the Leningrad State University (LSU) in 1958. In 1958-1960 she worked as a laboratory assistant at the LSU Astronomical Observatory and since 1960, at BAO. In 1961-1986 she was a junior research associate at BAO Department of Extragalactic Astronomy, and since 1987, research associate and the Head of BAO Photographic Archive. She had some 20 research papers published in 1961-1986 on photometry and colorimetry of galaxies, blue and variable stars, UV-excess objects. She passed away on 7 August 1994 after heavy decease at the age of 59. She was the wife of BAO astronomer Rafik Hovhannessian.

Tigran MOVSESSIAN – 60

Dr. Tigran Movsessian, one of the most productive Armenian astronomers and Deputy Director of BAO, celebrated his 60th anniversary. Tigran Hakob Movsessian was born on 8 November 1955 in Yerevan. He graduated from the Department of Physics, Yerevan State University (YSU) in 1978 and started working in BAO in 1979. He defended his PhD thesis in 1992 under the supervision of Tigran Magakian on “The spectral investigation of stellar jets”. He was researcher since 1994 and senior researcher since 1999. He was appointed the Head of BAO 2.6m telescope laboratory in 1998, after its renovation and reoperation with the help of Marseille astronomers team led by Jacques Boulesteix. Recently, in July 2015 he was appointed BAO Deputy Director for Technical Issues. Movsessian also lectures at Department of Astrophysics at YSU. His main research interests are evolution of young low-mass stars and their interaction with interstellar medium: T Tauri stars, Herbig-Haro objects, cometary and reflection nebulae, optical jets from young stars, as well as BCDGs and astronomical instrumentation. He has published some 80 papers in major astronomical journals, proceedings of meetings, etc. Tigran has more than 30 years of observations with large telescopes, mainly with Russian Special Astrophysical Observatory (SAO) 6m and BAO 2.6m telescopes, large experience of observations with most modern photometric and spectral equipment, large experience in designing and manufacturing of astronomical equipment and using of new observational methods on 2.6m telescope. He has designed and built VAGR multi-pupil spectrograph currently in use at 2.6m telescope. Movsessian has large experience of work at foreign astronomical centres (France, Germany, Russia) and he has been awarded a number of grants and fellowships, such as INTAS (2004-2009), NFSAT (2004-2005), ANSEF (2003, 2012, 2013, 2015), DAAD (2006), French-Armenian PICS/Jumelage (1994-2009), RA State Committee of Science (SCS) grants, etc. He was twice included in the SCS lists of 100 most productive scientists in Armenia (2013-2014, 2015). Movsessian is ArAS founding members since 1999, as well as member of EAS (since 2002) and IAU (since 2015).

Vahagn GURZADYAN – 60

Prof. Vahagn Gurzadyan is an Armenian mathematical physicist and head of Cosmology Center at Yerevan Physics Institute (YerPhI, at present: A. Alikhanyan National Laboratory), Yerevan, Armenia, best known for co-writing “Concentric circles in WMAP data may provide evidence of violent pre-Big-Bang activity” paper with Roger Penrose, and collaborating on Roger Penrose’s recent book “Cycles of Time”. Vahagn (Vahe) Grigor Gurzadyan was born on 21 November 1955 in Yerevan. His father Grigor Gurzadyan was a famous Armenian astrophysicist, the pioneer of Soviet space astronomy. Vahagn graduated from Yerevan State University (YSU) in 1977, and he was postgraduate

student in Theoretical Physics Department, Lebedev Physics Institute in Moscow (1977-1980). He defended PhD thesis in 1980 and Doctor of Science in Theoretical and Mathematical Physics thesis in 1988. In 1989 he lectured on dynamical systems in 4 Universities in Japan. He held visiting positions in several universities: University of Sussex (1996-1997) and since 2001 in University of Rome “La Sapienza”. The main topics of his research are chaos in non-linear systems, accretion onto massive black holes, stellar dynamics, and observational cosmology. Gurzadyan has papers predicting elliptical accretion disks formed in galactic nuclei at tidal disruption of stars near massive black holes; much later tidal mechanism has been associated to the flares observed in AGN. He has shown (with G.K. Savvidy) the exponential instability (chaos) in spherical stellar systems and has derived the collective relaxation time. He has formulated a list of 10 key problems in stellar dynamics. Gurzadyan has suggested and initiated the use of Compton Edge method for high accuracy testing of the light speed isotropy and the Lorentz invariance at GRAAL experiment in European Synchrotron Radiation Facility (Grenoble); the obtained limit became a reference number for Special Relativity extension models. Gurzadyan coined the concept of Information Panspermia which S. Webb attributed as Solution 23 of Fermi Paradox. That concept includes the hypothesis that the Universe can be full of traveling extraterrestrial life streams as low-complexity compressed bit strings at von Neumann automata network. Gurzadyan has shown that human genome and hence the terrestrial life possess low Kolmogorov complexity and hence the corresponding bit strings can be transmitted by Arecibo-type antenna to Galactic distances. Gurzadyan’s interests span collaboration with archaeologists on the Chronology of the ancient Near East using astronomical dating. His analysis of the Venus tablet of Ammisaduqa and of lunar eclipses of the 3rd dynasty of Ur led to the introducing of the Ultra-Low chronology of the 2nd-millennium ancient Near East. He has identified the Halley’s comet depicted on ancient coins of Armenian king Tigranes the Great, I c. B.C. as the earliest known image of that comet. Gurzadyan led a study with geneticists in Duke University introducing a new method to detect somatic mutations in genomic sequences, proposed a new viewpoint on the relation of thermodynamic and cosmological arrows of time, on pre-arrow. He has published 2 monographs, 180 papers in major physical and astrophysical journals and proceedings of meetings, and edited 6 books. He is a member of Euroscience Governing Board (elected in 1998, re-elected in 2002), he has been the Co-Editor of International Journal of Modern Physics D (2000-2010), of The European Physical Journal Plus (Springer) and of the book series “Advances in Astronomy and Astrophysics” (Taylor & Francis, UK). Gurzadyan is a Fellow of the Royal Astronomical Society (UK). He was twice included in the RA State Committee of Science (SCS) list of 100 most productive scientists in Armenia (2013-2014, 2015).

ArAS NEW MEMBERS

After Armenian-Iranian Astronomical Workshop held on 13-16 October 2015 in Byurakan, three Iranian astronomers joined ArAS.



Prof. Habib Khosroshahi, 44, Faculty Member (since 2008) and the Chair of the School of Astronomy, Institute for Research in Fundamental Science (IPM, Tehran) and the Acting President of the Astronomical Society of Iran (ASI). He also is the PI of Iranian National Observatory (INO) 3.4m telescope project, as well as he is the leader of Iranian team at International Olympiads on Astronomy and Astrophysics (IOAA). Before he worked at Institute for Advanced Studies in Basic Sciences (IASBS, Zanjan, Iran, 2001-2002), then at University of Birmingham (UK, 2002-2007), where he defended his Ph.D. thesis and then in Liverpool John Moores University (UK, 2007-2008). *Prof. Khosroshahi's* research fields are galaxy evolution, galaxy groups, as well as interstellar medium and variable stars. He has 70 publications in major astronomical journals. *Prof. Khosroshahi* has organized a number of meetings including ASI annual meetings and international workshops at IPM.



Prof. Sohrab Rahvar, 42, Faculty Member and the Head of Physics Department, Sharif University of Technology (SUT, Tehran). *Prof. Rahvar's* research interests are: 1. Gravitational Lensing and Microlensing – Extrasolar planets and 2. Modified gravity models: Alternative to Dark Energy – Dark Matter and Alternative Models. He is Member of an international collaboration for searching Extrasolar planets. He is teaching Cosmology and Analytical Mechanics at SUT. He is also Associate Member of the International Center for Theoretical Physics (ICTP, Trieste, Italy), Member of American Physical Society, Member of Internal Astronomical Union (IAU, since 2006), Member of Physical Society of Iran (PSI), and Member of Astronomical Society of Iran (ASI). Seven students have defended their PhD theses under supervision of *Prof. Rahvar*.



Dr. Shant Baghram, 32, Assistant Professor at Physics Department, Sharif University of Technology (SUT, Tehran). His main research field is Cosmology. Shant finished his Ph.D. in Physics Department of SUT in 2011 in Cosmology. His Thesis supervisor was *Prof. Sohrab Rahvar* and his Ph.D. Thesis title was “*The Observational Tests of dark Energy and Modified Gravity Theories*”. Then he was a Post-Doctoral fellow in the Astrophysics and Gravitation group at the Department of Physics and Astronomy, University of Waterloo, joined with the Cosmology and Gravitation group at the Perimeter Institute for Theoretical Physics (PI; 2011-2012) under supervision of *Dr. Niayesh Afshordi*. Later on, Shant was a Post-Doctoral fellow of School of Astronomy in Institute for Research in Fundamental Sciences (IPM, Tehran), mainly collaborating with theoretical group under mentorship of Hassan Firouzjahi (2012-2014).

ArAS ANNUAL FEES

Dear colleagues,

Several times we have reminded you to **pay ArAS membership fees**, which are in fact not very high (for the members residing in Armenia, just 5000 AMD annually). For foreign members, there are two categories of annual fees: USD 50 (Western Europe, USA & Canada) and USD 30 (other countries). Junior members pay half of the assigned fees in each category.

ArAS doesn't have any other income beside the membership fees and not-paying members create difficulties for our activities. As you know, we pay for the webpage (domain and hosting), where we have a lot of information for you, including created by ArAS personal webpages for each member, we organize meetings, schools and other events, we publish a number of promotional materials, etc., so that the society needs some current funds. In fact, any society can exist exceptionally due to its membership fees. As you know, ArAS also runs some dedicated projects with dedicated funding (ArAS Annual Prize for Young Astronomers, ArAS School Lectures, etc.).

However, according to the recent information from ArAS Treasurer *Dr. Marietta Gyulzadyan*, the collection of fees is rather passive. We have discussed this problem at our ArAS Council meetings and have decided to put strict deadline for the payments. We understand that for some of you it would be rather difficult to pay all previous debts, so we ask you to **pay the fees before December 31, 2015** for at least last two years (2014-2015).

We have decided that those members, who don't wish to pay the dues, will be excluded from ArAS after that deadline. We will publish ArAS members new list in the first issue of ArASNews in 2016.

Please contact me to decide what is the most convenient way of payment for you; bank transfer, cash, etc.

Thank you for your understanding and looking forward for future collaboration.

Sincerely yours,

Dr. Areg Mickaelian,
ArAS Co-President,
On behalf of the ArAS Council.

DECEMBER CALENDAR OF ASTRONOMICAL EVENTS

Monthly Calendar of Astronomical Events
DECEMBER 2015

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	1 Deadline for nominations for ArAS Annual Prize for Young Astronomers	2	3 Lunar crescent (last quarter)	4	5	6 Lunar occultation of Mars
7	8 Lunar occultation of Venus	9	10	11 New moon	12	13
14	15	16	17	18 Lunar crescent (first quarter)	19 Ursids meteor shower	20 Lunar occultation of Venus
21	22 Winter Solstice	23	24	25 Full moon	26	27
28	29	30	31 ArAS Newsletter #88 release	31	31	31