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ArAS SCHOOL LECTURES

On the initiative of ***Prof.*** **Yervant Terzian** (Cornell University, NY, USA), a Project of Astronomical Lectures in the schools of the Republic of Armenia (RA) was conducted by ArAS on November 21-25, 2016. Since astronomy is not a primary subject at RA schools, this project was a chance to partially compensate this gap. High schools, including some specialized schools were selected by the RA Ministry of Education and Science (MES), one from each province and others from Yerevan. The lectures were organized either in specialized classrooms with participation of at least 30 pupils, and in some cases in the school halls with participation of up to 200 people. Altogether 27 lectures were given by **5 astronomers** and Sona Farmanyan, expert in **Cultural Astronomy**:

- *Dr*. **Areg Mickaelian**, BAO Leading Research Associate, ArAS Co-President, Project Manager of the Armenian Virtual Observatory (ArVO), Director of IAU SWCA ROAD
- *Dr*. **Ararat Yeghikian**, BAO Senior Research Associate
- *Dr*. **Susanna Hakopian**, BAO Senior Research Associate, Coordinator of IAU SWCA ROAD TF1 *Universities and Research*
- *Dr*. **Marietta Gyulzadian**, BAO Research Associate and Teacher of Astronomy and Physics at Yerevan Physics-Mathematics Specialized School, Leader of the Armenian team at the International Astronomical Olympiads (IAO)
- **Avetik Grigoryan**, former BAO researcher (1983-1992), at present Head of the Space Group of Republican Technical Creativity Center of RA Ministry of Education and Science
- **Sona Farmanyan** (Cultural Astronomy), Coordinator of IAU SWCA ROAD TF3 *Astronomy for the Public*

A general **presentation on *"Wonders of the Universe"*** (PowerPoint file) was prepared, which included information on the history and modern state of astronomy, its present developments, achievements of BAO led by the outstanding scientist Viktor Ambartsumian and other famous astronomers, and a lot of beautiful pictures from the Universe. As agreed beforehand, all lectures were organized in classrooms with projectors.

A number of **promotional materials** were distributed to the schools libraries, teachers and pupils. ArAS and BAO publications were used as well and some were published and produced in frame of this project. The following materials were distributed:

- Brochure *"Byurakan Astrophysical Observatory"* (2011, in Armenian) by Areg Mickaelian, a visiting card of our main astronomical centre
- Photo booklet *"Byurakan Astrophysical Observatory"* (2012) with a collection of photos from BAO (territory, buildings, telescopes, etc.)
- Book *"Victor Ambartsumian"* (2008, in Armenian, Russian and English), compiled by Elma Parsamian, devoted to Ambartsumian's life and activities with memoirs of well-known scientists, Ambartsumian's students, colleagues and contemporaries

- Proceedings of the conference *"Relation of Astronomy to Other Sciences, Culture and Society"* (2015, in Armenian), a book presenting astronomy as a leader in inter- and multi- disciplinary sciences
- DVD *"Viktor Ambartsumian"* (2010, in Armenian, Russian and English) with a full collection of data on our great scientist (biography, his books and papers, articles about him, photos, movies, etc.)
- DVD *"Astronomy for Schools"* (2014, in Armenian, Russian and English) reproduced in frame of this project and containing a lot of necessary materials for the school astronomy: digitized textbooks and problem books, exercises, encyclopedia and thesauri, popular astronomical software, photos and movies, information on BAO, Viktor Ambartsumian and other famous Armenian astronomers, as well as the popular CD *"3D Atlas of the Universe"*
- Lunar calendars 2017
- BAO and ArAS souvenir pens

One of the goals of the project was the discovery of **talented pupils interested in astronomy**. We will maintain further contacts with them and follow their further growth as potential future scientists. For this, special forms were prepared and distributed in schools as feedback from this project. Hundreds of pupils have filled in and returned these forms with their contact data. On behalf of ArAS we acknowledge FAR and RA MES for their support and look forward for further activities.

To remind, **ArAS School Lectures** program runs since 2012 and so far, in **2012, 2013, 2014 and 2016** we have visited **66 schools** (some of them several times) in Yerevan, Armenian provinces and Artsakh and have delivered **95 lectures**. Our lecturers have been: Avetik Grigoryan, Marietta Gyulzadian, Susanna Hakopian, Haik Harutyunian, Gohar Harutyunian, Areg Mickaelian, Elena Nikoghosyan, Hovhannes Pikichian, Ararat Yeghikian, and Sona Farmanyan.

***Dr. Areg Mickaelian**, Project Manager*
***Sona Farmanyan**, Project Coordinator*

ROAD News: Astronomy in Georgia and Iran

Astronomy in Georgia – Present Status and Perspectives

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(Reprinted from the Proceedings of the Armenian-Iranian Astronomical Workshop,
held on 13-16 October 2015 in Byurakan, Armenia)

Abstract. Astronomy in Georgia is generally represented in Abastumani Astrophysical Observatory found in 1932. It is one of the leading scientific institutes in the country. Main fields of research are solar system bodies (including near-Earth asteroids), various aspects of solar physics, stellar astronomy (including binary stars and open clusters), extragalactic objects (AGNs), theoretical astrophysics, cosmology, atmospheric and solar-terrestrial physics. Several telescopes are operational today, as well as the instruments for atmospheric studies. In 2007 the Observatory was integrated with Ilia State University, merging scientific research and education which facilitated the growth of a new generation of researchers. There are groups of astronomers and astrophysicists in other Georgian universities and institutions as well. Georgian scientists collaborate with research centers and universities worldwide. Research groups participate in various international scientific projects. The interest in astronomy in Georgia has been growing, which increases future perspectives of its development in the country.

Keywords. Observatory – stellar astronomy – extragalactic astronomy – astrophysics – solar physics – cosmology – atmospheric physics – solar-terrestrial physics – history

1. Brief history of astronomy in Georgia

In ancient times astronomy in Georgia served as a tool for keeping track of time, seasons, establishing calendars, like in other parts of the world. The Georgian National Center of Manuscripts stores rare manuscripts starting from VII century. In XI - XIII centuries the observatories had been established in Kutaisi and Tbilisi where astrolabes had been used for observation of celestial bodies. The books in astronomy, translated from other languages and original ones had been issued (Ioanne Kartveli, Abuseridze-Tbeli). The most prominent Georgian literary work - Shota Rustaveli's poem "The Knight in the Tiger's skin" written in the XII century showed an advanced knowledge in astronomy of that epoch. The Georgian King Vakhtang VI (1675-1737) was one of the greatest Georgian educators who promoted astronomy in the country. Under his supervision, the Ulugh Beg's astronomical tables were translated and issued. Vakhtang VI's astrolabe is stored in the National museum in Tbilisi. At present astronomy in Georgia is generally represented in Abastumani Astrophysical Observatory (AAO) which is one of the leading scientific institutes in Georgia. It was established in 1932 when Georgia was a part of the Soviet Union. The first director of the Observatory from 1932 until 1992 was Evgeni Kharadze (1907-2001). Until 2007 AAO was an institute of the Georgian National Academy of Sciences. In 2007 the Observatory was integrated with the Ilia State University, where astronomical education was reestablished. The AAO is located in the South Caucasus region, on the top of the mount Kanobili with geographical coordinates N41^{0}45', E42^{0}49' at the altitude of 1600 a.s.l., 250 km South-West from Tbilisi, the capital of Georgia. It is situated far from industrial and polluted areas and is characterized by highly transparent and calm atmosphere. The first telescope of the observatory was a 33-cm

reflector built by Nikolai Ponomarev which also was the first Soviet reflecting telescope. The instrument is stored in the museum of the observatory. In 1937 the 40-cm refractor of the Carl Zeiss company was installed which operated until 1990-ies. 15 telescopes had been installed in AAO, including solar ones, as well as various instruments for atmospheric studies. In 1978 the biggest telescope of the observatory - the 125-cm Ritchie-Chretien telescope was mounted. Photographic, photometric, electrophotometric, spectroscopic, polarimetric observations, as well as theoretical studies had been carried out, studying variable and binary stars, star clusters, galaxy structure, extragalactic objects, the Sun and solar system bodies, the Moon. About 20000 photographic plates are stored in the "Glass library" of the Observatory. Some AAO data are also stored in the Strasbourg Astronomical Data Center. The atlas of dark nebulae and the lunar polarimetric atlas have been issued. The bulletin of AAO and astronomical calendar had been issued since 1960-ies.

2. Current research

Since 2007 E. Kharadze Abastumani Astrophysical Observatory (AAO) is a research institute at Ilia State University, merging scientific research and education. The research comprises almost all branches of astronomy and astrophysics: stellar and extragalactic astronomy, the Sun and solar system, theoretical astrophysics, cosmology, as well as atmospheric and solar-terrestrial physics. Although research in these fields are carried out in other institutions in Georgia as well: the Institute of Theoretical Physics at Ilia State University, Javakhishvili Tbilisi State University, School of Physics at Free University of Tbilisi.

2.1. Stellar and extragalactic astronomy

In AAO, the observations and comprehensive investigation of variably stars at different evolutionary stages, as well as binary stars have been carried out since 1930-ies. Study of close binary stars, the supergiant and pulsating variable stellar objects like RY Sct, Wolf-Rayet stars, Cyg X-1 are of particular interest (Kumsiashvili et al. 2014). The observational data is stored in the Strasbourg Astronomical Data Center – CDS (http://vizier.u-strasbg.fr/viz-bin/VizieR-2). Observations and study of flare stars and their possible mechanisms are performed in collaboration with Byurakan Observatory (Natshvlishvili and Kochiashvili 2008, Melikian et al. 2013,). The hypergiant star P Cyg and Be star EM Cep with observed flares are investigated, as well as Luminous Blue Variables and Wolf-Rayet Stars, in order to figure out the observational facts about evolutionary ties of these two types of stars (Kochiashvili 2007). Some other goals include solving the orbits of binary stars and asteroseismic investigations. Research is performed also in collaboration with the Shamakhy Observatory in Azerbaijan. The data are obtained by electrophotometric observations on the 48-cm telescope equipped with the CCD camera and UBVRI filters. Open clusters in the Galaxy are studied to reveal binary and multiple clusters using the method of determination of the cluster membership (Javakhishvili et al. 2006). The goal of research is to reveal double or multiple galactic open clusters like h and χ Persei, and their study through observations and numerical analysis. The high-energy study of blazars which are one of the most extreme class of extragalactic objects is carried out investigating their flux variability through different spectral bands, which is a powerful tool to study emission mechanisms, creating their energy budget (Kapanadze et al. 2014). It provides also a very effective tool to constrain the sizes of emitting regions, via the light-travel argument. The work is performed in collaboration with Palermo Institute of Astrophysics and Space Physics (Italy), the Swift Science Operations team (NASA) and the astronomy Department of Michigan University (USA). Optical observations of BL Lacertae objects since 1990-ies (Raiteri et al. 2015, co-authors Kurtanidze O. and other researchers from Georgia) and gamma-ray bursts (Mazeva et al. 2015, co-authors Inasaridze R. and Ayvazian V. from AAO) have been carried out on the 70-cm Meniscus telescope in Abastumani. These observations are parts of global networks. Theoretical studies of dynamics and structure of the Galaxy are carried out (Malasidze et al. 2014).

2.2 The Sun and solar system bodies

To search the near-Earth and potencially dangerous asteroids, the AAO, in cooperation with the Chugoevo Observatory of the Kharkov National University (Ukraine), participates in the ISON network and the European Space Agency mission GAIA (Thuillot et al. 2015, co-authors Inasaridze R. and Ayvazian V.). In the framework of this network, the photometric and astrometric monitoring of the near-Earth asteroids are performed which had led to the discovery of a binary asteroid (Scheirich et al. 2015, co-authors Inasaridze R. and others from AAO). One of the tasks of the AAO project is studying some physical characteristics of selected objects in the solar system (Jupiter's Galilean Satellites, Mars) and their monitoring. A large group of AAO researchers study different aspects of the magnetoseismology of the solar atmosphere and the solar weather. The main goal of it is to study the processes in the solar interior and atmosphere using observational data and analytical-numerical simulations. It consists of the following tasks: the active region dynamics during solar flares and coronal mass ejection (CME), their prediction and solar weather; the oscillations and flows in the solar chromosphere and corona; the solar tornadoes; the mid-range periodicities in solar atmosphere, their connection to magnetic Rossby waves and the tachocline seismology; the magnetic tubes and turbulence in the solar wind; the radio-seismology of outer solar corona and solar CME; the quasi-periodic pulsations during solar flares. Satellite data are used, namely, Atmospheric Imager Assembly (AIA) and Heliospheric and Magnetic Imager (HMI) on board of Solar Dynamic Observatory (SDO). Interface Region Imaging Spectrograph (IRIS) and ESA future mission – Solar Orbiter will be used as well. Most of the project participants are young researchers, among them are 9 PhD students. International collaboration includes the FP7 project SOLSPANET, projects of Austrian Science foundation (FWF), Austria-Poland scientific-technical cooperation project (WTZ mit Polen), Austria-India scientific-technical cooperation project (WTZ mit Indien), Rustaveli National Science Foundation project with Georgian scientists working abroad. Almost 40 papers had been published by the researchers of this group during last 5 years (the latest being Zaqarashvili et al. 2015). One of the recent papers (Mghebrishvili et al. 2015) was highlighted by the American Astronomical Society (http://aasnova.org/2015/10/05/a-tornado-on-the-sun/). Characteristics of solar rotation by coronal holes, dynamics and classification of coronal holes have been studied using the data of the SOLIS Vector Spectro Magnetograph - VSM (Kitt Peak Observatory) and SDO. Rotation rates of mass centers, recognizable pieces of coronal holes and variations of their areas in different phases of the solar activity, as well as possible relations between rotation rates of coronal holes and variations of solar magnetic activity are studied (Japaridze et al. 2015). Monitoring of active physical processes and waves in the upper layers of the solar atmosphere are performed on the basis of observations with high dispersion spectrograph and field observations of the solar eclipses. Monitoring of cyclic variation of polarization parameters (temperature and density) in the middle and outer solar corona can help in searching a solution of the mechanisms of coronal heating. The CCD time sequence spectroscopic observations of the emission spectral lines of these layers are to be obtained using the large non-eclipse coronagraph equipped with high-dispersion spectrograph**,** as well as Lyot-type small coronagraph at Abastumani (Khutsishvili et al. 2014).

2.3 Cosmology and theoretical astrophysics

The origin of cosmic magnetic fields, their evolution and observational evidence are studied using direct numerical models of MHD during cosmological phase transition and recombination (Kahniashvili et al. 2013). Modification of the numerical code PENCIL, calculations of the radiation transfer in the early Universe, study of plasma instabilities are carried out. Large-scale structure objects (SZ effect) are studied to find traces of magnetic fields. Dynamics of reionization and influence of magnetic fields on the formation of primordial objects are investigated. The E-polarization of cosmic microwave background, measured by PLANK satellite are studied. Gravitational wave generation by MHD turbulence are to be calculated. Growth rate in the dynamical dark energy models are studied (Avsajanishvili et al. 2014). Astrophysical flows and non-linear dynamics of various objects are studied. Regular and chaotic phenomena in disk flaws in the galaxies, the accretion disks of compact and protoplanetary objects are investigated by numerical simulations, as well as

dynamics of kinematically non-linear flaw in magnetized and non-magnetized continuous medium (Mamatsashvili et al. 2013). The group of astrophysicists of the Institute of Theoretical Physics at Ilia State University and School of Physics at Free University of Tbilisi are studying gamma-flares in Crab Nebula (Machabeli et al. 2015, Osmanov et al. 2015), as well as MHD turbulence in solar wind (Gogoberidze et al. 2012).

2.4. Atmospheric physics

Earth's atmosphere and near space research group is involved in theoretical and experimental research of the Earth's lower and upper atmosphere-ionosphere, their structural and dynamical variations at different helio-geophysical conditions, searching and monitoring of the signals produced by climate change (Didebulidze et al. 2011, Todua and Didebulidze 2014). Research include monitoring and theoretical study of the following parameters: the aerosol vertical distribution by lidar (ISTC grant, collaboration with the University of Michigan, USA), the total ozone content, mesopause temperature measurements by the spectrometer GRIPS 5 (collaboration with DLR), dynamical processes in the mesopause region by the all-sky Imager (RNSF grant, collaboration the Utah University, USA), photometric measurements of the atomic oxygen red 630 nm and green 557.7 nm lines of the nightglow spectrum. International cooperation include DLR, EARLINET and ACTRIS networks. Ground-based and satellite monitoring of stratospheric sulphate aerosol are studied by nightglow measurements (Mateshvii et al. 2013). The data of the GOMOS - the spectrometer onboard of the ENVISAT satellite are used. The reserachers work on the improvement of the aerosol retrieval algorithm. The obtained results will also be used in modeling of the daytime atmospheric limb brightness. The study is carried out in cooperation with Belgian Institute for Space Aeronomy.

2.5. Other fields

There archaeoastronomical studies are carried out of the old astro-archeological monuments in Georgia (Simonia et al. 2009). The astrobiology studies include investigation of the Mars surface irradiation by simulations (Tarasashvili et al. 2013).

3. Telescopes and instruments

At present in AAO the 70-cm Maksutov meniscus telescope, 53-cm azimuthal reflector, 22-cm reflector ORI, 40-cm double astrograph, 53-cm large and 11.5-cm small solar coronagraphs are operational. They are equipped with CCD cameras. Spectroscopic and photometric observations are carried out. The instruments for atsmopheric studies incude: aerosol lidar M-10 system, GRIPS-5 to measure the mezopause temperature, all-sky imager for measurements of some parameters of the nightglow, as well as the ozonometer. The new magnetometer to monitor the Earth's magnetic field has been installed recently. Astroclimatic conditions of Abastumani makes the location favorable for installation of advanced astronomical instruments, which is one of the main goals of the Observatory in the nearest future.

4. Education and public outreach

Astronomical education is mainly carried out at the faculty of natural sciences and engeneering of Ilia State Unviersity, in bachelor, master and doctorate levels. Students are offered the programs in stellar and extragalactic astronomy, solar physics, cosmology, theoretical astrophysics, and atmospheric physics. AAO serves as a basis for the practical part of the courses. General courses in astronomy for students of all profiles are also offered. The courses in astronomy are also offered in Javakhishvili Tbilisi State University, Free University of Tbilisi and Samtskhe-Javakheti State University in Akhaltsikhe. AAO has a program for visitors which include popular lectures and showing the museum of the Observatory (made under the USAID project). Amateur astronomy and astrophotography are emerged lately and become increasingly popular in Georgia.

5. International collaboration and future perspectives

AAO researchers collaborate with many research centers and universities worldwide, including Byurakan Astrophysical Observatory in Armenia with which we have close collaboration for decades, one of them being the development of Armenian-Georgian Virtual Observatory (Mickaelian et al. 2009). The Georgian researchers have established partnerships with colleagues in Azerbaijan, Belgium, Bulgaria, Germany, France, India, Italy, Japan, Poland, Russia, Spain, Turkey, Ukraine, UK, USA and other countries. They have collaborations with NASA, DLR, are widely involved in EU scientific programs and are planning to participate in Horizon-2020 program. These collaborations were mentioned in previous chapters. The interest in astronomy and adjacent sciences in Georgia has been growing rapidly, which increases future perspectives of its development in the country.

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Iranian National Observatory

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held on 13-16 October 2015 in Byurakan, Armenia)

Abstract. The Iranian National Observatory is under construction at an altitude of 3600m at Gargash summit 300km southern Tehran. The site selection was concluded in 2007 and the site monitoring activities have begun since then, which indicates a high quality of the site with a median seeing of 0.7 arcsec through the year. One of the major observing facilities of the observatory is a 3.4m Alt-Az Ritchey-Chretien optical telescope which is currently under design. This f/11 telescope will be equipped with high resolution medium-wide field imaging cameras as well as medium and high resolution spectrographs. In this review, I will give an overview of astronomy research and education in Iran. Then I will go through the past and present activities of the Iranian National Observatory project including the site quality, telescope specifications and instrument capabilities.

1. Introduction

The current research and training capabilities in observational astronomy in Iran is unable to meet the growing demand due to a rapid growth in higher education over the past two decades. While almost every big university in Iran has an astronomy department or group, the existing observational facilities consists of a number of small telescopes in various university campus observatories generally used for undergraduate and graduate training. An interim solution is found through collaboration with other observatories and as a result Iranian astronomers have been provided with access to optical 2-4m telescopes and radio arrays. Moreover the younger generation of astronomers are involved in various international astronomy projects and surveys. A medium size optical telescope is thought to be a step to facilitate research in astronomy and observational cosmology. The geographic location of Iran, 32N 53E, relative dry climate and high altitude mountains, offer suitable locations for optical telescopes. Site selection study for a proposed 2-4 meter class telescope started few years before the INO project received administrative approval. The study led by S. Nasiri between 2000 and 2007 involved collecting and analysis of metrological data, seismic hazard data, accessibility and shiny day statistics over central dry regions of the country. A large number of sites were identified and inspected. After potential sites, mostly scattered around the central desert, was reduced to a manageable number, long term seeing monitoring began and continued for two years on 4 different sites with altitudes between 2500m and 3600m.

2. Site location and characteristics

The atmospheric turbulence has a strong connection to astronomical seeing and is one of the most important site selection parameters provided that a reasonable number of clear nights is available and site benefits from a relatively dark sky. In particular the Fried parameter, r0, which represents the telescope aperture diameter, for which the diffraction-limited image resolution is equal to the FWHM of the seeing-limited image is shown to be determined by refractive index structure constant (Fried 1966) which itself depends on the temperature structure of the atmosphere (e.g. Marks et al 1996). Site characterization involved measurement of a number of key site parameters such as the wind speed and direction, sky brightness, seeing and microthermal variation profile at the two sites, known as Dinava (3000m) and Gargash (3600m). These two sites are 70km apart. The key objective of the monitoring was to find the best of the two sites for the installation of the 3.4m telescope, as part of the post site selection activity concluded in 2007.

Weather stations were installed in both sites on 12m masts by the end of 2008 positioned 9m above the surface. They allowed the measurement of temperature, wind speed and direction, barometric pressure and humidity as described in Khosroshahi et al (2010). Wind data recording was performed every 10 minutes at an 8m height above the peak. 4 years of measurements between 2009 and 2013 indicates a peak wind speed of 4.0-8.0 m/s for both sites but despite a 600m higher altitude, the wind speed in Gargash is generally lower than in Dinava. The west and south-west are generally the dominant wind directions in both sites (Khosroshahi 2010).

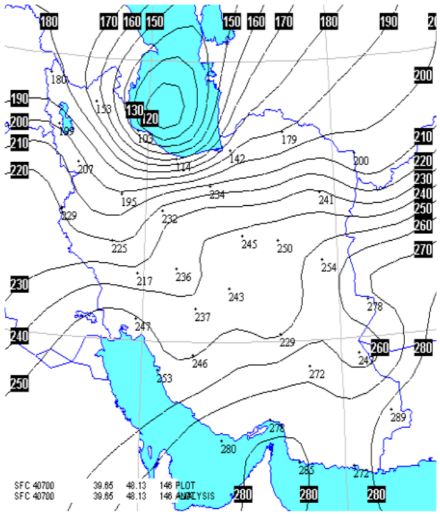

Fig 1. *Shiny day statistics in Iran based on meteosat data (Nasiri et al. 2006).*

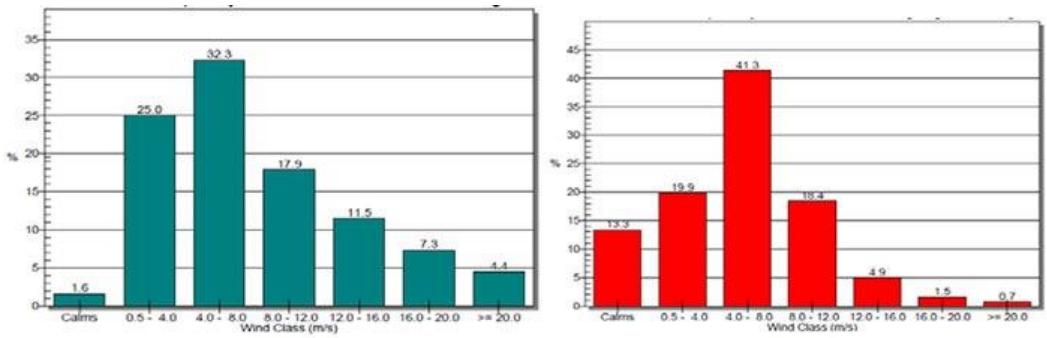

Fig 2. *A comparison of the wind speed distribution in Gargash (left) and Dinava (right).*

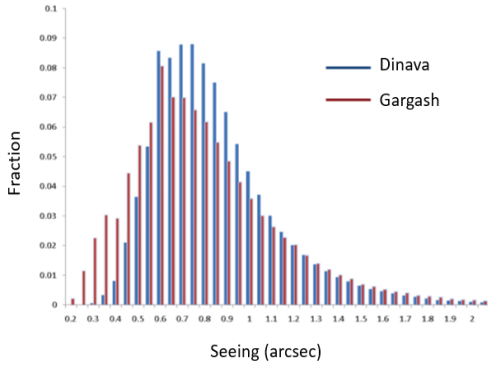

Fig 3. *Seeing comparison between Dinava and Gargesh.*
Data obtained for 3 months in summer 2010.

Statistically there is about 230 shinny days available for the region as reported by Nasiri et al (2006). Monitoring the cloud coverage over two years indicates that around 45% clear sky is available annually. This increases to above 70% between June-Oct. In about 55% of the nights the relative humidity remains below 60%. This increases to over 80% between May-Oct. There is no measurable difference between the two sites

in relative humidity. Temperature variation during the night (between twilights) is generally 3 degrees. The temperature changes at a rate of about 0.15 (±0.3) degree celsius per hour between sunset and midnight. Dinava site is generally about 5 degrees celsius warmer than the Gargash site.

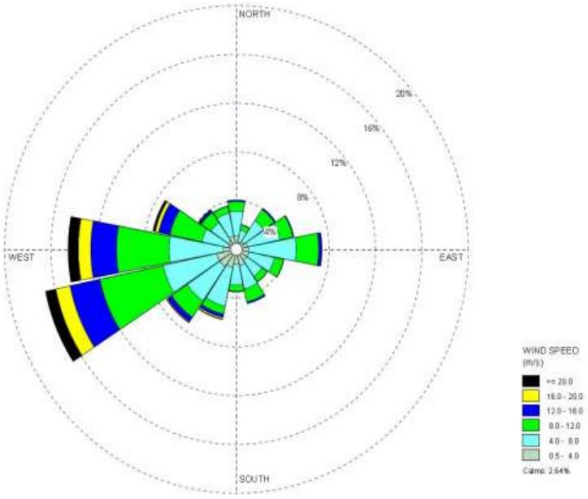

Fig 4. *Gargash annual night time wind rose.*

The INO 3.4 telescope will be installed at Gargash summit at longitude 51° 19' 7.7" E and latitude 33° 40' 27" N. As a result site preparation and road construction began since 2012. It is expected that a ~12km road construction will be concluded in 2016. Since 2014 a new remote control and automatic differential image motion monitoring system has been installed in Gargash summit.

Fig 5. *A view of the robotic site monitoring station on top Gargash summit.*

3. The telescope and operation

The telescope is currently under detail design based on the following design parameters.

Table 1. *Basic design parameters for the INO 3.4m optical telescope.*

Optical configuration	Ritchey-Chrétien Cassigrain
Wavelength range	325-2500 nm
Primary mirror diameter/central hole	3400/700 mm
Primary mirror focal ratio	f/1.5
Exit focal ratio	f/11.4
Cassigrain focus image scale	~ 0.2 mm/arcsec
Back focal distance	1750 mm
Unvignetted field of view diameter	20 arcmin

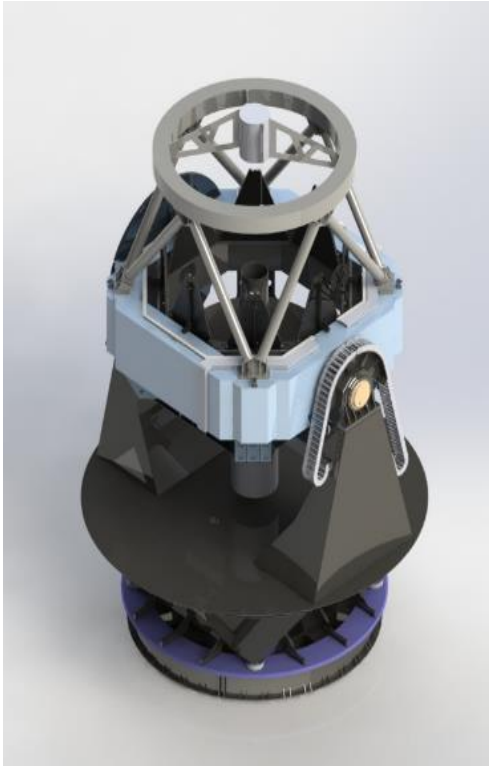

Fig 6. *A graphic view of the telescope under detail design.*

The primary mirror has been figured/polished and has been delivered to INO in March 2015. The mirror blank is a Zerodur glass figured to be a meniscus shape with 18 cm thickness and polished to have a roughness of around 3mm in small scale. The mirror will be actively controlled to preserve its nominal shape under its weight at different elevation angles. The active system is deceived by 60 actuators. The secondary mirror will be a classic controlled by a hexapod.

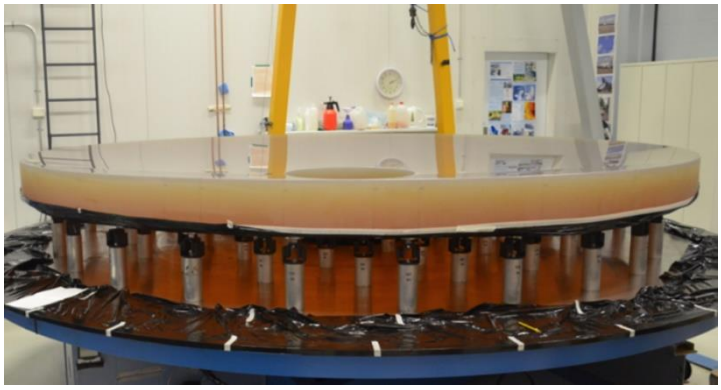

Fig 7. *A view of the INO 3.4m primary mirror polished blank.*

The control system architecture is described in Ravanmehr and Jafarzadeh (2015). The control system offers capabilities and utilities for four different types of users based on predefined privileges, visiting astronomer, staff astronomer, operator and engineer. The observatory operates in different modes which consists of Survey mode in which the observatory staff/students will carry out the TAC approved survey, visiting astronomer mode in which an approved observing run will be carried out by the visiting astronomer supervised by a staff astronomer and at the presence of an operator. The observatory will also benefit from a flexible scheduling systems for queue observations to increase the observing run efficiency. The initiation of this mode will be at the discretion of the staff astronomer. The staff astronomer have a deep knowledge of the telescope capabilities and current operational status, in addition to astronomy and sciences being carried out. The staff astronomer is also responsible for monitoring data acquisition and validation the integrity of data collected. Visiting astronomers are end users and may have a limited training and knowledge of telescope. Operators have a deep knowledge of telescope operational status. They have access to monitoring capabilities and some level of controls. Engineers can develop, test, calibrate and maintain the telescope. They have the highest level of access to telescope system and subsystems. This category of users are authorized for setting configuration parameters of telescope, problem investigation and resolving and information management.

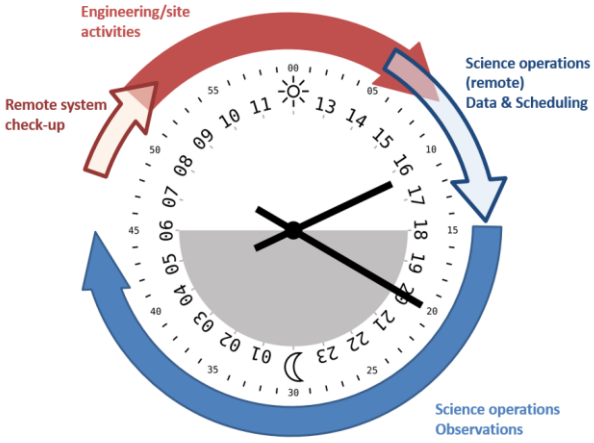

Fig 8. *The INO340 operation clock.*

4. Science and Instrumentation

While a large fraction of the INO340 telescope time will be dedicated to large programs or surveys, the INO340 is still general purpose telescope which can be used for various, solar system, galactic and extra-galactic studies. Photometric and Spectroscopic follow-up observations of radio, infrared and X-ray sources, clusters and groups of galaxies, stellar clusters, AGNs and quasars, galaxies, SN, gravitational lensing and microlensing, star formation in nearby galaxies, solar system and near earth objects are among the subjects of interests for the Iranian community of astronomers. A combination of these and the time-critical observations,

backed by the geographic location of the observatory drive the backend instruments configurations. Most of the thought instruments will be permanently mounted at 4 exists, e.g. the main Cassigrain focus (FoV~20 arcmin) and the 3 side ports (FoV~ 8 arcmin). Imaging and Spectroscopic capabilities together with Polarimetric capability will be provided. Instruments suitable for faint and bright objects, bright and dark time, good and poor observing conditions will be available. Fast switch between instruments with different capabilities to respond to time-domain observation and alerts and all times imaging and spectroscopic capabilities are among the requirements. The total weight of the back end instruments can be 2 tons while a heavier or more bulky instruments can be installed inside the enclosure building and be fiber fed. This offers more sensitive instruments thermal and vibration controlled environment.

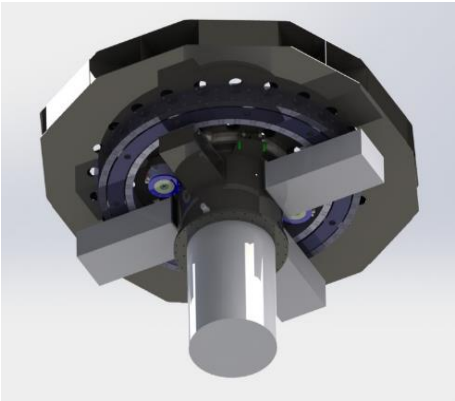

Fig 9. *Instrument configuration at the backend of the INO 3.4m telescope.*

5. Summary

The Iranian National Observatory is well under development, with site ready for construction and the basic observing facilities and the infrastructure such as the electricity and data connection in place. The INO 3.4m telescope and other astronomical observing facilities will be a major step towards brining astronomy back to where its rooted. The INO is willing and inviting partners from regional and international community for collaboration in the development and also the science operation.

Acknowledgements. I would like to thank the management, engineering and admiration of the Iranian National Observatory and technical staff of the technology Development Division in School of Astronomy. Iranian National Project is executed in the Institute for Research in Fundamental Sciences and is funded by the Ministry of Science, Research and Technology and Vice Presidency for Science and Technology.

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ArAS Annual Prize for Young Scientists

ArAS is pleased to announce the **ArAS Annual Prize for Young Astronomers (Yervant Terzian Prize) 2016**. 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).

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 the year (2016) including:

1. Scientific results (up to 1 page)
2. Letter from the supervisor describing the personal contribution of the nominee
3. Published, accepted and submitted papers (in refereed journals, in proceedings of meetings, and other)
4. Participation in meetings and schools
5. Given talks, seminars, and presented posters
6. Scientific mission
7. Honours, awards and research grants
8. Membership
9. Teaching activity
10. Organizational activity
11. Other activities, whatever is considered 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 own 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 deadline for applications has been extended until December 5. The winner will be announced in the last issue of ArAS Newsletter (#100) at the end of the year. A diploma and sum of $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.

SUPER MOON OBSERVATIONS IN ARMENIA

On November 14, astronomers across the world are keenly observing the stunning natural phenomenon: the largest supermoon in last 68 years. The full Moon of November 14 is not only the closest full Moon of 2016 but also the closest full Moon to date in the 21st century. The full Moon won't come this close to the Earth again until November 25, 2034.

Since the Moon's orbit is elliptical, one side (perihelion) is about 30,000 miles (50,000 km) closer to Earth than the other (aphelion). The word syzygy is the scientific name for when the Earth, the Sun, and the Moon line up, as the Moon orbits around the Earth. When perigee-syzygy of the Earth-Moon-Sun system occurs and the Moon is on the opposite side of the Earth from the Sun, we get the perigee Moon or more commonly, a Supermoon!

This coincidence happens three times in 2016. On October 16 and December 14, the Moon becomes full on the same day as perigee. On November 14, it becomes full within about two hours of perigee arguably making it an extra-supermoon.

On this occasion, "Goodricke JOHN amateur astronomers NGO" and "Fulfil a Dream" charity initiative organize an observation in the park near the Republic Square. More than 200 visitors had the opportunity to watch the undeniably beautiful Supermoon through four high quality telescopes mounted in the park and also help children from socially disadvantaged families to have a bright and happy New Year. They brought many gifts for them and also enjoyed the beauty of the Moon.

The purpose of "Goodricke John" NGO is to outreach astronomical knowledge through stargazing, and open astronomical parties, to popularize the amateur astronomy and the culture of star watching. Thanks to "Goodricke John" NGO every unique amateur astronomical event is being available to large group of people including disabled.

Tsovak Voskanyan & Vachik Khachatryan

RELEASE OF ASTROCURIER OCTOBER ISSUE

Preface to the readers

Announcement of conferences and symposiums

Chronical of Events and Results of Conferences

Official Ceremony dedicated to the 50th anniversary of SAO RAS

International Astronomical Conference “Physics of Stars: from Collapse to Collapse”

Local Workshop on Archaeoastronomy

75th Anniversary of Zasov Anatoly Vladimirovich

70th Anniversary of Alexander Anatolevich

70th Anniversary of Kazakh Astronomy

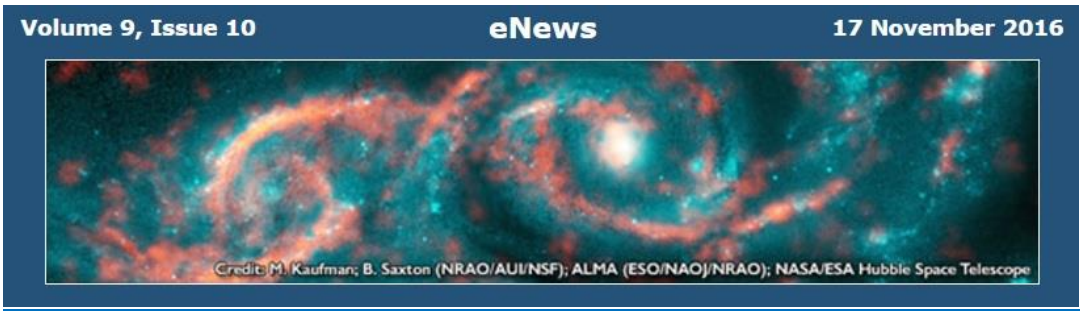
Release of ArASNews October Issue

Read the newsletter online at: http://www.sai.msu.ru/EAAS/rus/astrocourier/index.html

RELEASE OF IAU ASTRONOMY OUTREACH NEWSLETTER 2016, November #2

In this newsletter:

RELEASE OF NRAO NEWSLETTER NOVEMBER ISSUE



Upcoming Events

- NRAO Town Hall at the Jan 2017 AAS Meeting
  Jan 6, 2017 | Grapevine, TX
- ALMA Band 1 Science Workshop
  Jan 16 - 18, 2017 | Taipei, Taiwan
- ALMA Data Reduction Party
  Jan 25 - 27, 2017 | Charlottesville, VA
- Women in Astronomy IV: The Many Faces of Women Astronomers
  Jun 9 - 11, 2017 | Austin, TX

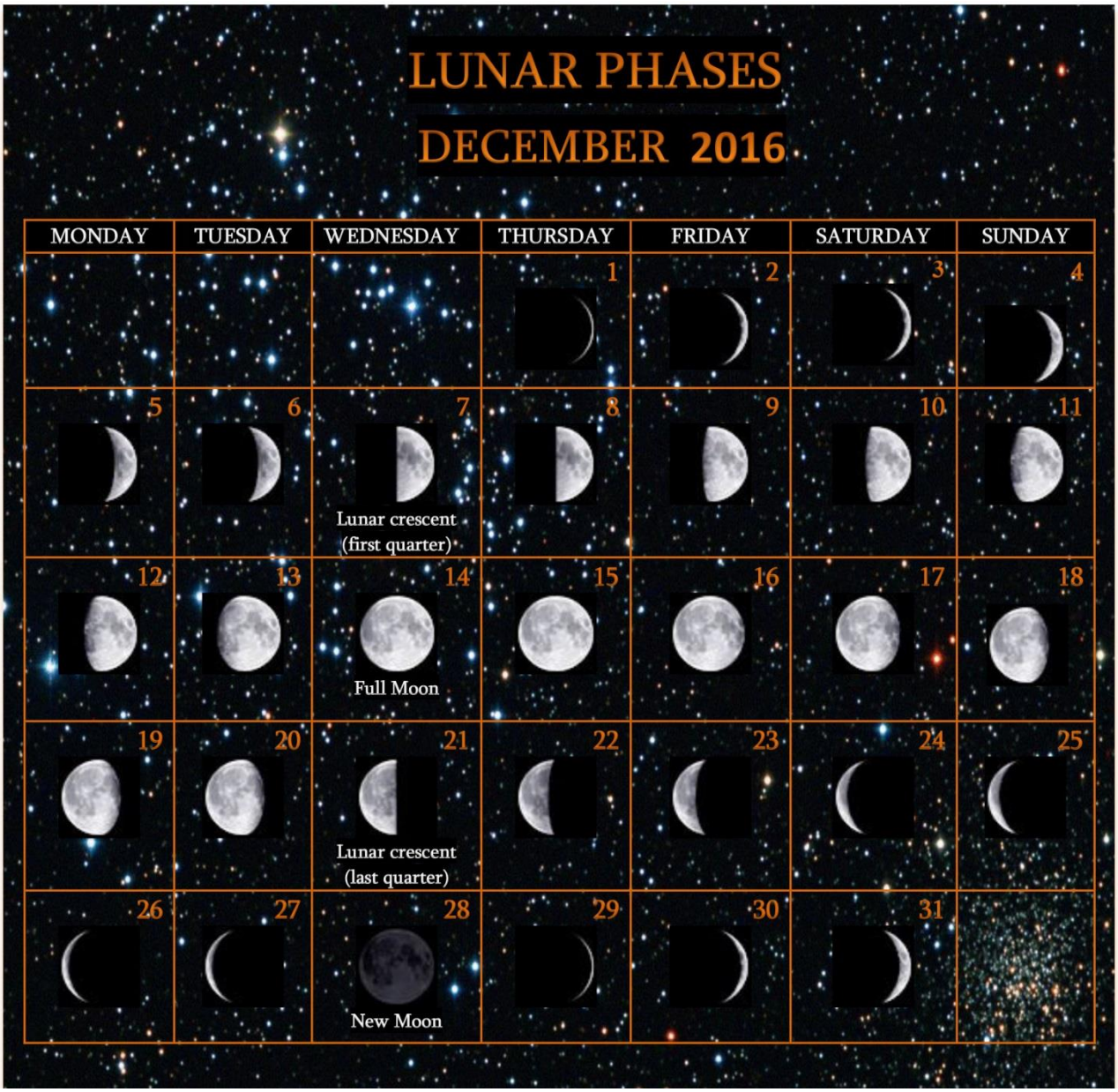
Recent Media Releases

Career Opportunities

From the Archives

National Radio Astronomy Observatory
A facility of the National Science Foundation

LUNAR PHASES OF DECEMBER



DECEMBER CALENDAR OF ASTRONOMICAL EVENTS