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Editor: Sona FARMANYAN

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TWENTY YEARS AFTER VIKTOR AMBARTSUMIAN

Viktor Ambartsumian was the greatest scientist in the whole history of Armenia, he was one of the greatest scientists of the XX century. Ambartsumian founded the Byurakan Astrophysical Observatory (BAO) in 1946. In fact, all major events in the Armenian astronomy after that were related to him, both scientific discoveries and other activities. Ambartsumian passed away on 12 August 1996, and now, 20 years after his death, we would like to summarize his most important achievements and the activities in the Armenian astronomy during 1996-2016.

Here we give 20 most important scientific results by Viktor Ambartsumian, which were selected and described in the booklet by Haik Harutyunian and Areg Mickaelian *"Viktor Ambartsumian. Most important scientific results"* (Yerevan, "EditPrint", 32 p., 2011) and in the DVD by Areg Mickaelian "Viktor Ambartsumian" (Yerevan, 2008).

Viktor Ambartsumian's 20 most important scientific results

1. For the first time **the problem of finding the differential equation corresponding to the known family of eigenvalues** was solved. For the time a **problem inverse to Sturm-Liouville's problem was** formulated, which later became a starting point to create an entire field of analogical class inverse problems (1929).

W.A. Ambarzumjan – Uber eine Frage der Eigenwerttheorie (On a Problem of the Theory of Eigenvalues) // Zeitschrift fur Physik, Vol. 53, Nos. 9-10, p. 690-695, 1929 (in German).

2. An idea that not only the quanta of the electromagnetic field, photons, but also **other particles (including particles having nonzero rest mass) may be born and disappear as a result of their interaction with other particles** (this idea lays in the basis of modern physics of the elementary particles and quantum field theory) (together with *D.D. Ivanenko*, 1930).

W.A. Ambarzumjan, D.D. Iwanenko – Eine quantentheoretische Bemerkung zur einheitlichen Feldtheorie (A Quantum-Theoretical Remark on the Uniform Field Theory) // Доклады Академии Наук СССР, сер. А (Doklady USSR Acad. Sci., Ser. A), Vol. 3, p. 45-49, 1930 (in German).

3. The **impossibility of existence of free electrons in the atomic nuclei** was proved. It was shown that **only electrically uncharged elementary particles of approximately proton mass could exist together with protons in nuclei.** Two years later James Chadwick discovered the neutron (together with *D.D. Ivanenko*, 1930).

W.A. Ambarzumjan, D.D. Iwanenko – Uber eine Folgerung der Diracschen Theorie der Protonen und Elektronen (On a Consequence of the Dirac Theory of Protons and Electrons) // Доклады Академии Наук СССР, сер. А (Doklady USSR Acad. Sci., Ser. A), Vol. 6, p. 153-155, 1930 (in German).
V.A. Ambartsoumian, D.D. Ivanenko – Les electrons inobservables et les rayons β (The Inobservable Electrons and β Rays) // Compte rendu hebdomadaire des seances de l'Academie des sciences de Paris, Vol. 190, No. 9, p. 582-584, 1930 (in French).

4. For the first time the **influence of the light pressure on the planetary nebulae dynamics** was studied. The new result on the **expansion and dissipation of planetary nebulae** owing to light pressure was obtained. It was shown that the age of planetary nebulae could not exceed 100000 years if no continuous outflow existed from the central star. For the first time the new evolutionary paradigm on formation of objects from denser matter was formulated (1932).

V.A. Ambartsumian – The Radiative Equilibrium of a Planetary Nebula // Monthly Notices of the Royal Astronomical Society (MNRAS), Vol. 93, No. 1, p. 50-61, 1932 (in English).

5. New method (modification of Zanstra's method) **for determination of the planetary nebulae's central stars surface temperature** giving the probabilistic definition of short wave energetic photons transformation into less energetic ones. This definition led to the radiative equilibrium determination (1932). This method bears V. Ambartsumian's name.

V.A. Ambartsumian – On the Temperatures of the Nuclei of Planetary Nebulae // Циркуяр Пулковской Обсерватории (Poulkovo Observatory Circular), No. 4, p. 8-12, 1932 (in English).

6. For the first time the **amount of matter and masses of envelopes ejected due to the Novae and Supernovae explosions** was estimated. Presently known values of 0.00001 and 1 solar masses for Novae and Supernovae phenomena have been found, respectively (together with *N.A. Kozirev*, 1933).

W.A. Ambarzumjan, N.A. Kosyrew – Uber die Massen der von den neuen Sternen ausgestossenen Gashullen (On the Masses of Envelopes thrown out by Novae) // Zeitschrift fur Astrophysik, Vol. 7, No. 4, p. 320-325, 1933 (in German).

7. For the first time the **distribution function of stellar 3D velocities has been obtained only using radial velocities and coordinates** of stars. This problem has been reduced to the numerical inversion of the Radon transform. Four decades later the same mathematical scheme was applied for the construction and exploitation of computer tomography (1936).

V.A. Ambartsumian – On the Derivation of the Frequency Function of Space Velocities of the Stars from the Observed Radial Velocities // Monthly Notices of the Royal Astronomical Society (MNRAS), Vol. 96, No. 3, p. 172-179, 1936 (in English).

8. By means of investigation of white stars at low Galactic latitudes, the existence of a **great number of white dwarf stars in the Galaxy** was shown, which was later proved by discoveries of a large number of white dwarfs (together with *G.A. Shain*, 1936)

V.A. Ambartsumian, G.A. Shain – On the Faint White Stars in Low Galactic Latitudes // Астрономический Журнал (Soviet Astronomy), Vol. 13, No. 1, p. 1-7, 1936 (in English).

9. Using the statistical studies of wide binaries it was shown for the first time that those did not obey the dissociative equilibrium conditions. The same studies allowed to arrive at a conclusion that the **components of binaries had been formed jointly.** Moreover, the observed distribution put an **upper limit for the Galaxy age, 10 billion years.** This proved incorrectness of the generally accepted estimate of the age of our Galaxy obtained by James Jeans (so-called "long scale", 10^{13} years) was shown and a new estimate of its age was given (so-called "short scale") (1936-1937).

V.A. Ambartsumian – Double Stars and the Cosmogonic Time-Scale // Nature, Vol. 137, No. 3465, p. 537, 1936 (in English).
В.А. Амбарцумян – К статистике двойных звезд (On the Statistics of Double Stars) // Астрономический Журнал (Astron. Zh.), Vol. 14, No. 3, p. 207-219, 1937 (in Russian).

10. Principles of statistical mechanics of stellar systems. The **mechanism of star "evaporation" from the open stellar clusters** was revealed. Using of this effect allowed to find for the first time the halftime of disintegration of the clusters, and was applied to anticipate the gradual decrease of the number of low mass stars in clusters. It was proven that open star clusters disintegrate during about 1 billion years, and predict the process of impoverishment of the clusters with dwarf stars. These studies provided a theoretical base for decreasing the accepted age of the Galaxy for a thousand times and for introducing "the short scale" of the Galaxy age (1938).

В.А. Амбарцумян – К вопросу о динамике открытых скоплений (On the Dynamics of Open Clusters) // Труды АО ЛГУ; Уч. зап. ЛГУ, Серия мат. наук (Астрономия), вып. 4 (Trudy LGU; Ucheniye Zapiski LGU, Ser. Math. Sciences (Astronomy). Issue 4), No. 22, p. 19-22, 1938 (in Russian).

11. The **nature and patchy structure of the interstellar absorbing matter** (dust component of the Milky Way) was revealed and the **mean absorption of individual clouds was estimated** to be equal to 0.2 magnitudes (together with *Sh.G. Gordeladze*, 1938).

V.A. Ambartsumian, Sh.G. Gordeladze – Problem of Diffuse Nebulae and Cosmic Absorption // Бюллетень Абастуманской АО (Bulletin of the Abastumani Astrophysical Observatory), No. 2, p. 37-68, 1938 (in English and Georgian).

12. Development of light scattering theory in turbid medium, **theory of Invariance**. The Invariance principle was proposed for solving the radiative transfer problems. A very simple physical reasoning that the reflection properties of the semi-infinite plane-parallel medium do not change if a very thin layer of the same physical properties is added to its boundary gave an excellent base for creation of a new research method (1941-1942). This principle bears V. Ambartsumian's name and the corresponding function was named V. Ambartsumian's φ function.

В.А. Амбарцумян – Новый способ расчета рассеяния света в мутной среде (A New Method of Calculation of the Light Scattering in Turbid Medium) // Известия АН СССР, серия географическая и геофизическая (Izvestiya Acad. Sci. USSR, Ser. Geograph. and Geophys. Sci.), Vol. 3, p. 97-103, 1942 (in Russian).
V.A. Ambartsumian – The Scattering of Light in a Turbid Medium // Journal of Physics, Vol. 5, No. 1, p. 93, 1941 (in English).

13. The **theory of the fluctuations in brightness of the Milky Way** was formulated. In the simplest form it asserts that the probability distribution of fluctuations in the brightness of the Milky Way is invariant to the location of the observer (1944).

В.А. Амбарцумян – К теории флюктуации яркости Млечного Пути (To the Theory of Fluctuation in the Brightness of the Milky Way) // Доклады Академии Наук СССР (Doklady USSR Acad. Sci.), Vol. 44, No. 6, p. 244-247, 1944 (in Russian).

14. Discovery of stellar associations, groups of hot giants and T Tauri stars. It was shown for the first time that the star formation process continues at all stages of the evolution of our Galaxy, including the present one and that the star formation is a permanent process. A conclusion was drawn that **stars are formed** not individually, but **in groups** (1947).

V.A. Ambartsumian – Evolution of Stars and Astrophysics // Acad. Sci. ArmSSR, 39 p., Yerevan, 1948 (in Armenian).
В.А. Амбарцумян – Предварительные данные об О-ассоциациях в Галактике (Preliminary Data on O-Associations in the Galaxy) // Доклады Академии Наук СССР (Doklady USSR Acad. Sci.), Vol. 68, No. 1, p. 21-22, 1949 (in Russian).

15. Theoretical prediction of the phenomenon of expansion of stellar associations. Revealing the importance of the stellar associations as dynamically unstable entities. Statistics of the Trapezium Orionis type systems and a **proof of disintegration of the young stellar systems** (together with *B.E. Markarian*, 1949-1951).

В.А. Амбарцумян – Звездные ассоциации (Stellar Associations) // Астрономический Журнал (Astron. Zh.), Vol. 26, No. 1, p. 3-9, 1949 (in Russian).
В.А. Амбарцумян, Б.Е. Маркарян (V.A. Ambartsumian, B.E. Markarian) – Звездная ассоциация вокруг P Лебедя (Stellar Association around P Cygni)
// Сообщения Бюраканской обсерватории (Communications of the Byurakan Observatory), No. 2, p. 3-17, 1949 (in Russian).
В.А. Амбарцумян – О вероятности кажущихся кратных систем типа Трапеции Ориона (On the Frequency of the Orion Trapezium type Apparent Multiple Systems) // Доклады Академии Наук АрмССР (Doklady Acad. Sci. ArmSSR), Vol. 13, No. 4, p. 97-103, 1951 (in Russian).
В.А. Амбарцумян – К статистике кратных систем типа Трапеции (On the Statistics of Trapezium type Multiple Systems) // Доклады Академии Наук АрмССР (Doklady Acad. Sci. ArmSSR), Vol. 13, No. 5, p. 129-131, 1951 (in Russian).

16. Showed the **nonthermal nature of the continuous emission** observed in the spectra of non-stable stars and put forward an idea about new possible sources of stellar energy, the **hypothesis of the superdense protostellar matter** (1954). This hypothesis bears V. Ambartsumian's name.

В.А. Амбарцумян – Явление непрерывной эмиссии и источники звездной энергии (The Phenomenon of the Continuous Emission and Sources of Stellar Energy) // Сообщения Бюраканской обсерватории (Communications of the Byurakan Observatory), No. 13, p. 1-36, 1954 (in Russian).

17. The hypothesis on the activity of galactic nuclei was proclaimed. The various forms of activity were presented as different manifestations of the same phenomenon of activity. The evolutionary significance of the activity in the galactic nuclei was emphasized and a further hypothesis was suggested on the ejection of new galaxies from the active galactic nuclei. The hypothesis on the superdense protostellar matter was engaged to explain the observational data (1956). This hypothesis bears V. Ambartsumian's name.

В.А. Амбарцумян – К вопросу о природе источников радиоизлучения (On the Nature of Radio Sources) // Труды Пятого совещания по вопросам космогонии: "Радиоастрономия", 9-12 марта 1955 г., АН СССР (Proc. Fifth conference on Problems of Cosmogony: "Radioastronomy", held on 9-12 Mar 1955. Acad. Sci. USSR), p. 413-416, Москва (Moscow), 1956 (in Russian).
В.А. Амбарцумян – О кратных галактиках (On Multiple Galaxies) // Известия АН АрмССР, серия физико-математических, естественных и технических наук (Izvestiya Acad. Sci. ArmSSR, Ser. Phys.-Math., Nat. and Tech. Sci.), Vol. 9, No. 1, p. 23-43, 1956 (in Russian).

18. Theoretical studies of the hypothetical superdense degenerate protostellar matter: **development of principles of the theory of baryonic stars**, which allowed a detailed research of physical conditions in superdense stellar conditions in the frame enabled by the modern knowledge of physics. These researches later on allowed increasing the Chandrasekhar limit of stellar masses (together with *G.S. Saakyan*, 1960-1961).

В.А. Амбарцумян, Г.С. Саакян (V.A. Ambartsumian, G.S. Saakyan) – О вырожденном сверхплотном газе элементарных частиц (The Degenerate Superdense Gas of Elementary Particles) // Астрономический Журнал (Astron. Zh.), Vol. 37, No. 2, p. 193-209, 1960 (in Russian) // English translation in: Soviet Astronomy, Vol. 4, No. 2, p. 187-201, 1960.
В.А. Амбарцумян, Г.С. Саакян (V.A. Ambartsumian, G.S. Saakyan) – О равновесных конфигурациях сверхплотных вырожденных газовых масс (On Equilibrium Configurations of Superdense Degenerate Gas Masses) // Астрономический Журнал (Astron. Zh.), Vol. 38, No. 5, p. 785-797, 1961 (in Russian) // English transaltion in: Soviet Astronomy, Vol. 5, No. 5, p. 601-610, 1962.
В.А. Амбарцумян, Г.С. Саакян (V.A. Ambartsumian, G.S. Saakyan)
– Внутренное строение гиперонных конфигураций звёздных масс (Internal Structure of Hyperon Configurations of Stellar Masses) // Астрономический Журнал (Astron. Zh.), Vol. 38, No. 6, p. 1016-1024, 1961 (in Russian) // English transaltion in: Soviet Astronomy, Vol. 5, No. 6, p. 779-784, 1962.

19. Statistical studies of the flare stars revealed their evolutionary status: a method for estimation of the total number of flare stars in a star system based on the number of the observed flares. The flare activity was shown to be the regular stage in the evolutionary path of the low luminosity and low mass late-type stars. It was proved that all the **stars**of the mentioned category necessarily **pass through the stage of flare activity** in the early phases of their evolution (1968).

В.А. Амбарцумян – К статистике вспыхивающих объектов (On the Statistics of Flare Objects) // Труды симпозиума "Звезды. Туманности. Галактики", посвященного 60-летию академика В.А. Амбарцумяна, Бюракан, 16-19 сентября 1968 г., АН АрмССР (Proc. symp. "Stars, Nebulae, Galaxies", devoted to the 60th anniversary of academician V.A. Ambartsumian, held in Byurakan, 16-19 Sep 1968. Acad. Sci. ArmSSR), p. 283-292, Ереван (Yerevan), 1969 (in Russian).

20. Obtaining an original solution of the inverse problem of derivation of the **distribution function of average frequencies of flares in the given stellar system** on the basis of chronology of discovery (first flares) and confirmation (second flares) of the flare stars (1978).

В.А. Амбарцумян – Вывод распределения частоты звёздных вспышек в звёздном агрегате (Derivation of the frequency function of stellar flares in a star cluster) // Астрофизика (Astrofizika), Vol. 14, No. 3, p. 367-381, 1978 (in Russian) // English translation in: Astrophysics, Vol. 14, No. 3, p. 209-217, 1978.

Of course, such prominent scientific achievements became possible due to the genius of Viktor Ambartsumian. Moreover, a lot of other results and achievements by other Armenian astronomers were also accomplished due to Ambartsumian's ideas and theories. After his death, during these 20 years short time, of course one could not expect similar results, however we are happy to summarize all activities in Byurakan and in the Armenian astronomy in general to show that astronomy is still one of the most important fields in Armenia. We give 20 most important events occurred in the Armenian astronomy after Viktor Ambartsumian, during 1996-2016.

20 most important events in the Armenian astronomy after Viktor Ambartsumian

1996 – **BAO 2.6m telescope refunctioning** after 5-year stop; due to the French-Armenian collaboration and support of the Marseille Observatory team, the telescope for the first time started to work with digital equipment (ByuFOSC reducer)

1998, August 17-21, BAO – **IAU Symposium #194: *Activity in Galaxies and Related Phenomena***, dedicated to V.A. Ambartsumian's 90th anniversary; 100 participants from 22 countries; first IAU symposium in the independent Armenia

2001, June 18-22, BAO – **IAU Colloquium #184: *AGN Surveys***, dedicated to the memory of B.E. Markarian; 92 participants from 16 countries

2001 – **foundation of the Armenian Astronomical Society (ArAS)** and its affiliation to the European Astronomical Society (EAS); ArAS unifies 100 astronomers from 17 countries

2002-2005 – **Digitized First Byurakan Survey (DFBS)**, digitization of Markarian Survey 1874 plates and creation of the largest Armenian astronomical database (20 million low-dispersion spectra); in collaboration with Italy, USA and Germany

2004 – Establishment of **ArAS Annual Prize for Young Astronomers (Yervant Terzian Prize)**, at present USD 500, awarded annually to the most active young scientist from BAO or elsewhere

2005, July – creation of the **Armenian Virtual Observatory (ArVO)** and its affiliation to the International Virtual Observatories Alliance (IVOA) as one of the 19 national projects

Byurakan International Summer Schools

2006, August – Foundation of the **Byurakan International Summer Schools (BISS)**, biannual summer schools for MSc and PhD students, post-docs and young astronomers

2007, August 20-25, Yerevan – **Joint European and National Astronomical Meeting (JENAM-2007): *Our non-stable Universe***, 256 participants from 31 countries, 8 symposia and 6 special sessions – the largest scientific event ever organized in Armenia

2008 – **Viktor Ambartsumian's 100th anniversary** celebration: 2BISS, 2 international symposia, publication of books, production of "Viktor Ambartsumian" DVD, opening of monument

2009 – Establishment of **V. Ambartsumian International Science Prize** (USD 500,000), one of the largest science prizes in the world; awarded on biannual basis to scientists having outstanding contribution in astronomy, astrophysics, physics or mathematics

2010, September 12 – October 2 – **3BISS combined with the IAU 32nd International School for Young Astronomers (ISYA-2010)**. 48 students from 19 countries

2011 – **Markarian Survey and DFBS** were included in **UNESCO *"Memory of the World"* (MOW) International Register**; one of the 10 Armenian values included in UNESCO lists

2012 – recognition of **BAO as National Value** by the RA Government; tripling of the total funding starting from 2013 and establishment of large funding for the infrastructure

2013, October 7-11, Yerevan – **IAU Symposium #304: *Multiwavelength AGN Surveys and Studies***, dedicated to B.E. Markarian's 100th anniversary; the largest individual astronomical symp. ever held in Armenia (141 participants from 28 countries)

2014 – **BAO 2.6m telescope mirror refurbishment** due to BAO additional funding for infrastructures; the mirror was aluminized and more efficient observations became possible

2014, October 7-10, BAO – **Conference *"Relation of Astronomy to other Sciences, Culture and Society"* (RASCS)**; participation of experts from various fields; promotion of astronomy as the leader of inter- and multi- disciplinary sciences

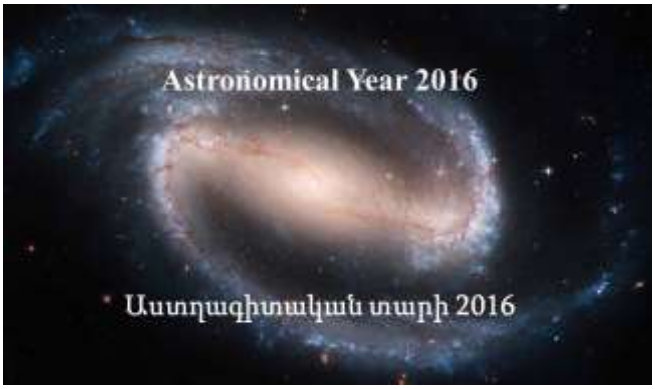
2015, June – Establishment of the **IAU South West Asian Regional Office of Astronomy for Development (SWA ROAD)** in Armenia, later expanded to **South West and Central Asian (SWCA) ROAD**; joined countries: Georgia, Iran, Kazakhstan and Tajikistan

2015, October 5-8 – **Symposium "Astronomical Surveys and Big Data"**, dedicated to the 50th anniversary of Markarian Survey and the 10th anniversary of the Armenian Virtual Observatory (ArVO); participation of astronomers and computer scientists

2015, October 11 – **BAO 1m Schmidt telescope "first light"** after 24 years of stop; the telescope was renovated and for the first time due to support of the Special Astrophysical Observatory (SAO, Russia) team

Among other important events one may also mention the celebration of **Anania Shirakatsi's 1400th anniversary** in 2012 and further development of **Archaeoastronomy and Astronomy in Culture (AAC)** matters in Armenia, creation of the **International Centre for Relativistic Astrophysics Network (ICRANet) Armenian Branch** at the Armenian National Academy of Sciences in 2013, **BAO Plate Archive project** (2015-2017): digitization, creation of electronic database and interactive sky map, and scientific usage, aimed at preservation and use of BAO 37,000 astronomical photographic plates obtained in 1947-1991, creation of **ArAS electronic newsletter "ArASNews"** in 2002 – a source of information on research, astronomical events and other activities of the Armenian astronomy, creation of an informative **ArAS webpage** in 2009 with full information on the Armenian astronomy.

CHRONOLOGY of ASTRONOMICAL EVENTS in 2016



January

- Research groups headed by Areg Mickaelian and Hayk Abrahamyan were awarded **Armenian National Science and Educational Fund (ANSEF) 2016 grants** (USD 5000 each)
- The group of Naira Azatyan, Knarik Khachatryan and Ani Vardanyan was awarded **BAO research grant for young scientists 2016**. The Scientific Adviser is *Dr*. Elena Nikoghosyan. The total funding is AMD 2,500,000
- **Laboratory of Astrophysical Research** was established at the Department of Physics of the Yerevan State University (YSU). The Laboratory is attached to the Chair of General Physics and Astrophysics after Viktor Ambartsumian
- **Susanna Hakopian** was appointed **Programme Coordinator of Task Force 1 (TF1)** Universities and Research of the IAU South-West and Central Asian ROAD
- 09.01.2016: Arthur Nikoghossian's 75th anniversary
- 10.01.2016: Arsen Kalloghlian's 85th anniversary
- 17.01.2016: Emilia Karapetyan's 60th anniversary

February

- 11.02.2016**: The discovery of gravitational waves** – opening a new window for study of the Universe. Gravitational waves emitted from the merging of two black holes with 29 and 36 Solar masses were detected. According to the calculations, some 3 Solar masses were transformed into gravitational waves, which had maximum radiation power about 50 times stronger than that from the entire visible Universe
- New blue-sensitive back-illuminated **Tektronix 1K CCD** receiver was installed in BAO 2.6m telescope SCORPIO camera
- An **All-Sky observing device** was installed on BAO main administrative building showing in real time mode the whole sky around Byurakan
- Creation of ***"BAO as Scientific Tourism centre"*** **webpage** and development of BAO visits and tours packages; webpage address: http://www.aras.am/SciTourism/eng/

March

- **Byurakan Astrophysical Observatory (BAO) 2.6m telescope** started to work regularly with time distribution principle
- 02-04.03.2016, Cape Town, South Africa: The **3rd Face-to-Face Meeting of Regional Offices of Astronomy for Development**; participation of Armenia (IAU SWA ROAD Director Areg Mickaelian and IAU SWA ROAD TF3 Coordinator Sona Farmanyan)
- 16.03.2016, Armenian Institute of Tourism (AIT), Yerevan, Armenia: **Conference *"Scientific Tourism in the South West Asian Region"*** organized jointly by ArAS and AIT

- 25.03.2016: visit of Yerevan basic school #12 named after Viktor Ambartsumian pupils to Byurakan Astrophysical Observatory (BAO)
- 27.03-02.04.2016: IAU South West Asian Regional Office of Astronomy for Development (SWA ROAD) team (Areg Mickaelian, Susanna Hakopian, Sona Farmanyan, Gor Mikayelyan) had a **mission to Georgia**. Two 2-day workshops in Tbilisi and in Abastumani
- 29.03.2016: **Final Phase of the School Republican Astronomical Olympiad** at Yerevan Phys.-Math. School. 1st-rank diploma: Edgar Vardanyan (Yerevan Phys.-Math. School, PMS), Ashot Matevosyan ("Quantum" College), Ara Mambreyan (PMS), Eduard Khalafyan ("Quantum"). 2nd-rank diploma: David Gevorgyan (PMS), Hrachya Babujyan (PMS), Hayk Harutyunyan (PMS), 3rd-rank diploma: Mher Khachatryan (PMS), Tigran Galstyan (PMS). Republican Jury Chair: *Dr.* Ashot Hakobian. Selection of participants for IAO and IOAA
- 30.03.2016: The **2016 Edinburgh Medal** was jointly awarded to Kevin Govender from IAU's Office of Astronomy for Development (OAD) and the IAU Edinburgh International Science Festival, to recognise their wide-reaching contribution to science
- 03.03.2016: Martik Hovhannisyan's 60th anniversary

April

- 04-09.04.2016, Oberpfaffenhofen, Germany: **COST Action TD 1403 "Big Data Era in Sky and Earth Observation" ("BigSkyEarth") 1st Training School**; Mihran Vardanyan's and Gor Mikayelyan's participation
- 11.04.2016, Department of Physics, University of Naples Federico II, Naples, Italy: Invited seminar by *Dr.* Areg Mickaelian *"AGN research using Multi-Wavelength Big Data"*
- 14-16.04.2016, Brno, Czech Republic: **COST Action TD 1403 *"Big Data Era in Sky and Earth Observation"* ("BigSkyEarth") Workshop and Management Committee meeting**; Areg Mickaelian's and Mihran Vardanyan's participation
- 20.04.2016: **NAS RA Annual Meeting**, Division of Physics and Astrophysics, where *Dr.* Tigran Movsessian and *Prof.* Armen Sedrakian (Germany) gave talks
- 22.04.2016: Visit of Armenian National Science and Educational Fund (ANSEF) grant winners to BAO
- 22-24.04.2016, BAO: participation of Armenian team to **NASA International Space Apps Challenge** Hackathon related to mobile applications, software, hardware, data visualizations and platform solutions that could contribute to space exploration missions and help improve life on Earth
- 28.04.2016, BAO: Press-conference and seminar for journalists interested in Scientific Journalism, on the occasion of BAO 70th anniversary
- 03.04.2016: *Dr.* Arsen Kalloghlian (1931-2016) passed away in Yerevan

May

- 02.05.2016: **Special Breakthrough Prize in Fundamental Physics** awarded for detection of gravitational waves 100 years after Albert Einstein predicted their existence. Selection Committee of previous Breakthrough Prize winners recognizes contributors to experiment recording waves from two black holes colliding over a billion light years away. $3 million prize shared between LIGO founders Ronald Drever, Kip Thorne and Rainer Weiss and 1012 contributors to the discovery
- 04.05.2016: **Gruber Prize 2016 in the field of Cosmology Winners** were announced: Ronald Drever, Kip Thorne, Rainer Weiss, and the LIGO Discovery Team along with the contributions of a thousand collaborators *for pursuing a vision to observe the universe in gravitational waves, leading to a first detection that emanated from the collision of two black holes*
- 10.05.2016: Armenian State Committee for Science (SCS) announced the results of the **contest *"Most Productive Young Scientists"***. 31 scientists were awarded grants, among them 2 astrophysicists: *Dr.* Artur Hakobyan (BAO) and *Dr.* Narek Sahakyan (ICRANet Center)
- **A Speckle-Interferometer was installed on BAO 2.6m telescope** in frame of the Armenian-Spanish-Russian joint project

- 12-23.05.2016: BAO Deputy Director on International Affairs Areg Mickaelian's and BAO Scientific Secretary Elena Nikoghosyan's visit to **Central Asia (Uzbekistan, Kazakhstan and Tajikistan)** to renovate former contacts and collaboration and establish new possible collaborations and projects
- 14-18.05.2016, Toledo, Spain: **IAU Symposium #321:** ***Formation and evolution of galaxy outskirts***
- 26.05.2016, BAO: Visit of representatives of travel agencies and guides for discussion of Scientific Tourism matters
- 28.05.2016, Metzamor: Visit of representatives of travel agencies and guides
- 01.05.2016: Radik Martirosyan's 80th anniversary
- 05.05.2016: Eduard Chubaryan's 80th anniversary
- 28.05.2016: Gonzalo Alcaino's 80th anniversary

June

- 03.06.2016: **Seminar *"Astrobiology and Extrasolar Planets"*** at YSU Department of Biology for YSU specialists and students by *Dr.* Areg Mickaelian, invited by *Dr.* Nelli Hovhannisyan, Head of a Chair at YSU Department of Biology
- 05.06.2016, Zorats Karer: Visit of representatives of travel agencies and guides
- 11-12.06.2016, BAO: Traditional annual visit of **Armenian Youth Aerospace Society (AYAS)** club pupils. Organizer: Avetik Grigoryan
- **Kazakhstan and Tajikistan** officially joined IAU SWA ROAD, which was renamed to **IAU South-West and Central Asian (SWCA) ROAD**
- 20-23.06.2016, NAS RA, Yerevan: **Young Scientists Conference *"Cultural Astronomy in Armenian Highland"***
- 23-24.06.2016: Participation of the **360 degree fulldome astronomical educational movie** created by the Technology & Science Dynamics R&D astrophysics team led by Levon Aramyan in 2016 Global Entrepreneurship Summit (GES 2016) in Silicon Valley, CA, USA
- 27.06-02.07.2016, Tenerife, Canary Islands, Spain: **Starmus Festival III *"Beyond the Horizon – Tribute to Stephen Hawking"*** organized by *Prof.* Garik Israelian. A big delegation from Armenia participated, including astrophysicist *Dr.* Areg Mickaelian and expert in cultural astronomy Sona Farmanyan
- 27.06.2016, BAO: Invited seminar *""* by Vladimir Airapetian (NASA, USA)
- 19.06.2016: Rudolf Muradian's 80th anniversary

July

- 04-08.07.2016, Athens, Greece: **The European Week of Astronomy and Space Science** (**EWASS**, formerly JENAM). Participation of Areg Mickaelian (with talks), Artur Hakobyan and Hayk Abrahamyan from Armenia and Gagik Tovmassian from Mexico
- 02-14.07.2016, Alakol, Kazakhstan, Gurgen Paronyan participated in the **International School-Seminar *"Spectrophotometry of Astronomical Objects: Theory and Practice"***
- 15.07.2016: According to the decision of the V. Ambartsumian International Science Prize International Steering Committee, **the Prize was not awarded in 2016**
- 18-22.07.2016, Cairns, Australia: **IAU Symposium #322:** ***The Multi-Messenger Astrophysics of the Galactic Centre***
- 29.07.2016: Publication of the **Proceedings of the International Symposium *"Astronomical Surveys and Big Data"***, held on 5-8 Oct 2015 in Byurakan, Armenia, by the Astronomical Society of the Pacific Conference Series (ASPCS Vol. 505). Edited by A. M. Mickaelian, A. Lawrence & T. Yu. Magakian. In English

August

- **Exoplanet "Proxima b" was discovered** around the nearest star to the Sun, Proxima Centauri, which may be suitable for life. Proxima b is an Earth-size rocky planet (1.2 times the Earth's radius and 1.3 times the Earth's mass) at a distance of 4.2 light-years from our Solar System, it is in the habitable zone of its star, and there may be water on its surface. The planet orbits the star Proxima Cen with a period of 11.2 days and is at a distance of 0.05 AU (7.5 million km) from her, much closer than the distance of Mercury from the Sun
- 12.08.2016: 20 years of Victor Ambartsumian's decease
- 15-18.08.2016, Research Institute for Astronomy and Astrophysics of Maragha (RIAAM), Iran: Areg Mickaelian (IAU SWCA ROAD Director) and Sona Farmanyan (IAU SWCA ROAD TF3 Programme Coordinator) participated with invited lectures in the **8th Advanced Astrophysics Workshop of Maragheh**
- 21.08-08.09.2016, Tehran, Iran: the IAU **38th International School for Young Astronomers (ISYA)**. 40 students from Afghanistan, Azerbaijan, India, Iran, Jordan and Russia, lecturers from China, France, Germany, India, Iran, Mexico, South Africa, and USA. Organizer: Habib Khosroshahi
- 22-27.08.2016, BAO: **3rd Byurakan Science Camp (3BSC)** with participation of 25 pupils. Organizers: Areg Mickaelian, Sona Farmanyan
- 29.08.2016: 15th anniversary of the foundation of the **Armenian Astronomical Society (ArAS)**
- 20.08.2016: Yuri Vartanyan's 80th anniversary

September

- 07.09.2016, BAO: Visit of the chairs and other representatives of the Students' Scientific Societies of the Armenian universities to promote further students tours to BAO
- 11-13.09.2016, Denver, Colorado, USA: **International Data Week** – World Data System (WDS) Forum and SciDataCon meeting. Participation of BAO representative Areg Mickaelian
- 12-16.09.2016, Ljubljana, Slovenia: **IAU Symposium #324:** ***New Frontiers in Black Hole Astrophysics***
- 12-23.09.2016, Byurakan, Armenia: **5th Byurakan International Summer School (5BISS)** for young astronomers. 27 students from Armenia, Georgia, Iran, Russia, Turkey and Ukraine and 15 lecturers from 9 countries
- 18.09.2016: Viktor Ambartsumian's 108th anniversary, **Astronomy Day in Armenia**. Observations organized by "Goodricke John" amateur astronomers' club
- 18.09.2016: Publication of Areg Mickaelian's **booklet** ***"Byurakan Astrophysical Observatory"*** by the "EditPrint" Publ. House. In English
- 19.09.2016, NAS RA, Yerevan, Armenia: **Solemn Session dedicated to the 70th anniversary of BAO**
- 19-23.09.2016, Yerevan and Byurakan, Armenia: **International Conference** ***"Non-Stable Universe: Energetic Resources, Activity Phenomena and Evolutionary Processes"*** dedicated to the 70th anniversary of BAO. Participation of 76 astronomers from 17 countries, inlcuding 30 foreign scientists
- 21-23.09.2016, Yerevan, Armenia: **PanArmenian Scientific Forum** was organized by Young Scientists Support Program (YSSP) with an Astronomy session; lectures were given by *Prof.* Garik Israelian (Institute of Astrophysics of Canary Islands, Spain) and *Prof.* Alexander Lazarian (University of Wisconsin-Madison, USA)
- 22.09.2016: Publication of the **Proceedings of the Armenian-Iranian Astronomical Workshop**, held on 13-16 Oct 2015 in Byurakan, Armenia. Edited by A. M. Mickaelian, H. Khosroshahi & H. A. Harutyunian. In English

- 26-27.09.2016, Ohrid, Macedonia: **OPTICON Awareness Conference on *"Hot topics in Astrophysics"*** for South Eastern European Countries and **SREAC Board meeting**. Participation of Areg Mickaelian with 2 talks
- 02.09.2016: Vahe Oskanian's 95th anniversary
- 15.09.2016: Misak Eritsian's 80th anniversary

October

- Armenian State Committee for Science (SCS) announced the results of the **contest *"Most Productive Scientists"***. 97 scientists were awarded grants, among them 5 astrophysicists: Vahagn Gurzadyan (Alikhanyan National Laboratory, former YerPhI), Tigran Magakian (BAO), Areg Mickaelian (BAO), Tigran Movsessian (BAO) and Aram Saharian (YSU Department of Theoretical Physics)
- 03-07.10.2016, Paralia Katerini, Mount Olympus, Greece: **The ISM-SPP Olympian School of Astrophysics**. Participation of Hasmik Andreasyan
- 05-13.10.2016, Plovdiv, Bulgaria: **21st International Astronomy Olympiad (IAO XXI)**. Participation of 16 teams, including Armenia (4 pupils). Areg Grigoryan took a bronze medal. Team leaders: *Dr.* Marietta Gyulzadyan and Avetik Grigoryan
- 06-07.10.2016, Tbilisi, Georgia: **European Eastern Partnership e-Infrastructure Conference (EaPEC)**. Areg Mickaelian's participation with an invited talk
- 09-13.10.2016, Cartagena de Indias, Colombia: **IAU Symposium #327: *Fine Structure and Dynamics of the Solar Atmosphere***
- 10-11.10.2016: Armenian Tavush Province Shamshadin region 15 pupils, **the winners of the "My Universe" essay contest**, visited BAO. All of them received Avetik Grigoryan's book *"From the Deep of Ages to the Universe"*. Organizers: ArAS and FAR
- 10-14.10.2016, Beijing, China: **IAU Symposium #323: *Planetary nebulae: Multi-wavelength probes of stellar and galactic evolution***
- 17-21.10.2016, Maresias, Brazil: **IAU Symposium #328: *Living around Active Stars***
- 17.10.2016, BAO: Visit of the Famous French-Armenian astronomer **Agop Terzan**
- 20-24.10.2016, Sorrento, Italy: **IAU Symposium #325 *Astroinformatics* (AstroInfo16)**. Participation of *Dr.* Areg Mickaelian with a talk *"Multi-wavelength studies of the statistical properties of active galaxies using Big Data"*
- 24-25.10.2016, Sorrento, Italy: **COST Action 1403 BigSkyEarth Conference *"Education in Big Data Era"***. Participation of *Dr.* Areg Mickaelian and Aneta Baloyan with talks on Astronomical and Informatics Education in Armenia
- 26.10.2016: **The European Commission** presented its new space strategy ***"Space Strategy for Europe"*** (COM (2016) 705 final)
- 29.10.2016: ***Prof.* Radik Martirosyan** was elected a **Foreign Member of the Russian Academy of Sciences**
- 06.10.2016: Artur Karapetyan's 60th anniversary

November

- 07.11.2016, BAO: Invited seminar *"Presentation of the accomplished works on BAO 1m telescope and its current state"* by Serguei Dodonov (SAO, Russia)
- 08-10.11.2016, Brussels, Belgium: **H2020 Space NCP meeting**. Areg Mickaelian's participation
- 14.11.2016: **Supermoon**, the largest since 1948. 14% larger and 30% brighter that the average full Moon. Observations organized by "Goodricke John" amateur astronomers' club
- 21-25.11.2016: **ArAS School Lectures series** in Yerevan and RA provinces specialized and high schools by 5 astronomers (*Dr.* Areg Mickaelian, *Dr.* Ararat Yeghikian, *Dr.* Susanna Hakopian, *Dr.* Marietta Gyulzadian, Avetik Grigoryan) and expert in Cultural Astronomy Sona Farmanyan. Books

and promotional materials distributed to schools. Organizers: ArAS and RA Ministry of Education and Science

- 24.11.2016: IAU Press Release: IAU Formally Approves **227 Star Names**. The creation of a specialised IAU Working Group, the Working Group on Star Names (WGSN), was approved by the IAU Executive Committee in May 2016 to formalise star names that have been used colloquially for centuries
- 28.11-02.12.2016, Auckland, New Zealand: **IAU Symposium #329: *The lives and death-throes of massive stars***
- 21.11.2016: Srbuhi (Sofik) Iskandaryan's (Iskudaryan's) 80th anniversary
- 12.11.2016: Norair Asatrian (1954-2016) passed away in Yerevan

December

- 09-19.12.2016, Bhubaneswar, India: **10th International Olympiad on Astronomy and Astrophysics (IOAA X)**. Participation of 48 teams, including Armenia (4 pupils). Ashot Matevosyan took a bronze medal. Team leader: *Dr.* Marietta Gyulzadyan
- 12.12.2016: **BAO 2016 Annual General Meeting;** Director *Dr.* Haik Harutyunian's report on BAO scientific results and other activities in 2016
- 19.12.2016, BAO: Invited seminar by *Prof.* Mohamad Bagheri (Iran) *"History of sundials in Iran"*
- 19.12.2016: *Dr.* Satenik Ghazaryan was awarded study grant by "Young Scientists Support Program – 2016" for the study of *"Statistical study of chemically peculiar stars based on new measurements of element abundance"*
- 20.12.2016: The **Pan-STARRS project** at the University of Hawaii Institute for Astronomy (UH IfA) publicly released the world's largest digital sky survey from the Space Telescope Science Institute (STScI) in Baltimore, MD, USA
- 21.12.2016, NAS RA, Yerevan, Armenia: **Summary of the Astronomical Year 2016** by Haik Harutyunian and Areg Mickaelian
- 21.12.2016: **ArAS Annual Prize for Young Astronomers 2016** (Yervant Terzian Prize) was awarded to **Anahit Samsonyan**, young researcher from BAO
- 21.12.2016: **Galileo Teachers Training Program (GTTP)** international certificate was awarded to **Levon Aramyan** (for the creation of the 360 degree fulldome astronomical educational movie) and **Sona Farmanyan** (for the idea and organization of the Byurakan Science Camps in 2014, 2015 and 2016)
- 21.12.2016: **BAO-70 Scientific Journalism Prizes**: Arpi Jilavyan (Panorama.am; *for the best printed or online article*), Marianna Ghahramanyan (Ararat TV; *for the best TV or radio program*), and Ani Karapetyan (Asekose.am; *for the most active scientific journalist during 2016*); also **Certificates to Mass Media**: "168 zham" (168.am) newspaper, "Tesaket" press-club and Tesaket.info information portal, "Armenpress" news agency, Marie Tarian for her "Gitamard" project ("Mediamax")
- 21.12.2016: Publication of the **Proceedings of the Young Scientists Conference *"Cultural Astronomy in the Armenian Highland"*** held on 20-23 June 2016 in Yerevan, Armenia. Editors: S. V. Farmanyan, Yu. M. Suvaryan & A. M. Mickaelian. In Armenian with English Abstracts
- 21.12.2016: Presentation of the new **documentary film *"Byurakan Astrophysical Observatory"*** (in frame of the Astronomical Tourism project)
- **Calendar of Astronomical Events 2017** release on ArAS webpage
- Creation of the webpage *"Astro Tourism in South West Asia"* for development of further activities: http://iau-swa-road.aras.am/eng/AstroTourism/
- 13.12.2016: Marietta Gyulzadyan's 60th anniversary

CODATA RECOMMENDED VALUES OF THE FUNDAMENTAL PHYSICAL CONSTANTS

The **International Council for Scientific Unions** (ICSU) **Committee on Data for Science and Technology** (CODATA, www.codata.org) is to promote global collaboration to improve the availability and usability of data for all areas of research. CODATA supports the principle that research data should be as open as possible and as closed as necessary. By promoting the policy, technological and cultural changes that are essential to make research data more widely available, CODATA helps advance ICSU's mission of strengthening international science for the benefit of society. The CODATA Strategic Plan 2015 http://dx.doi.org/10.5281/zenodo.50343 and Prospectus of Strategy and Achievement 2016 https://doi.org/10.5281/zenodo.165830 identify three priority areas:

- promoting principles, policies and practices for Open Data and Open Science;
- advancing the frontiers of data science;
- building capacity for Open Science by improving data skills and the functions of national science systems needed to support open data.

CODATA achieves these objectives through a number of standing committees, Task Groups and Working Groups as well as executive-led activities. CODATA supports the Data Science Journal http://datascience.codata.org/ and collaborates on major data conferences like SciDataCon http://www.scidatacon.org/2016/ and International Data Week http://internationaldataweek.org/.

Recently an important paper was published related to CODATA activities:

Peter J. Mohr, David B. Newell, Barry N. Taylor – ***CODATA recommended values of the fundamental physical constants: 2014**** // **Rev. Mod. Phys. 88, 035009** – Published 26 September 2016, at http://journals.aps.org/rmp/abstract/10.1103/RevModPhys.88.035009 (this review is being published simultaneously by the *Journal of Physical and Chemical Reference Data*).

This paper gives the 2014 self-consistent set of values of the constants and conversion factors of physics and chemistry recommended by the Committee on Data for Science and Technology (CODATA). These values are based on a least-squares adjustment that takes into account all data available up to 31 December 2014. Details of the data selection and methodology of the adjustment are described. The recommended values may also be found at physics.nist.gov/constants.

This report describes work carried out under the auspices of the Task Group on Fundamental Constants, one of several task groups of the Committee on Data for Science and Technology (CODATA) founded in 1966 as an interdisciplinary committee of ICSU. It gives a detailed account of the 2014 CODATA multivariate leastsquares adjustment of the values of the constants as well as the resulting 2014 set of over 300 self-consistent recommended values. The cutoff date for new data to be considered for possible inclusion in the 2014 adjustment was at the close of 31 December 2014, and the new set of values first became available on 25 June 2015 at physics.nist.gov/constants, part of the website of the Fundamental Constants Data Center of the National Institute of Standards and Technology (NIST), Gaithersburg, Maryland, USA.

IAU FORMALLY APPROVES 227 STAR NAMES

The creation of a specialized IAU Working Group, the Working Group on Star Names (WGSN), was approved by the IAU Executive Committee in May 2016 to formalize star names that have been used colloquially for centuries. WGSN has now established a new catalogue of IAU star names, with the first set of 227 approved names published on the IAU website.

Composed of an international group of astronomers, the Working Group on Star Names (WGSN) is an initiative that stemmed from the IAU Division C (Education, Outreach, and Heritage). Under the scope of the Division, the WGSN is expected first to delve into worldwide astronomical history and culture, with the aim of cataloguing traditional star names, and approving unique star names with standardised spellings. In the future, it is anticipated that the group will turn its focus to defining the rules, criteria and process by which new names for stars and significant substellar objects can be proposed by members of the international astronomical community, including professional astronomers and the general public.

For many years, the standard practice for astronomers has been to name the stars they study using an alphanumerical designation. These designations are practical, since star catalogues, such as that recently released from ESA's Gaia satellite, typically contain thousands, millions, or even billions of objects. These alphanumerical designations will continue to be used and will not be changed by the WGSN. Instead, the group aims to decide which traditional star names from cultures around the world are the official ones, in order to avoid confusion. Some of the most common names for the brightest and most famous stars in the sky had no official spelling, some stars had several names, and identical names were sometimes used for completely different stars altogether.

Historically, the IAU has only ever approved the names of 14 stars, in connection with the naming of exoplanets. There were two catalysts for the creation of the WGSN: the undertaking by the IAU to involve the international astronomical community in naming newly discovered exoplanets and their host stars, and a formal commitment to ensuring that astronomical heritage is preserved, one of the goals of the IAU Division C.

“Since the IAU is already adopting names for exoplanets and their host stars, it has been seen as necessary to catalogue the names for stars in common use from the past, and to clarify which ones will be official from now on,” says Eric Mamajek, chair and organiser of the WGSN.

The etymologies of the chosen names can differ, but some basic guidelines are followed by the WGSN. For instance, shorter, one-word names are preferred, as are those that have their roots in astronomical, cultural or natural world heritage. This is to preserve continuity and to ensure the long history of astronomical discovery is recognised. Many cultures around the world have traditional names for bright stars and asterisms. Most names still in use today have their roots in Greek, Latin and Arabic cultures, while some have more recent origins in the 19th and 20th centuries. Many have undergone little change since the Renaissance, which saw a proliferation of artistic celestial globes and atlases, and published star catalogues. The WGSN is archiving these names from the numerous different sources, and investigating opportunities to incorporate names from ancient astronomical traditions around the world into an official, IAU-approved list of star names for use by astronomers, navigators and the general public.

It is not the first time the IAU has examined historical names very closely: “A similar effort was conducted early in the history of the IAU, in the 1920s, when the 88 modern constellations were clarified from historical literature, and their boundaries, names, spellings, and abbreviations were delineated for common use in the international astronomical community. Many of these names are used today by astronomers for designations of variable stars, names for new dwarf galaxies and bright X-ray sources, and other astronomical objects," says Mamajek.

The WGSN has established and is maintaining a new catalogue of IAU star names, with the first set of 227 approved names published on the IAU website in the:

Naming Stars Theme

(https://www.iau.org/public/themes/naming_stars/)

The catalogue includes 18 star names approved by the IAU Executive Committee Working Group for Public Naming of Planets and Planetary Satellites in December 2015 (which included 5 ancient names and 14 new names proposed and voted on by the public via the NameExoWorlds contest), and 209 recently approved names from deliberations by the WGSN. This number is expected to grow, as the WGSN continues to revive ancient stellar nicknames and add new ones from the astronomical community around the world.

Among the names formally approved by the WGSN are Proxima Centauri (for the nearest star to the Sun and host star of the nearest known exoplanet), Rigil Kentaurus (the ancient name for Alpha Centauri) and names for dozens of bright stars commonly used for astronavigation. Among the stars with newly approved names that have recently been reported to host extrasolar planet candidates are: Algieba (Gamma-1 Leonis), Hamal (Alpha Arietis), and Muscida (Omicron Ursae Majoris).

XAVIER BARCONS APPOINTED AS NEXT ESO DIRECTOR GENERAL

The ESO Council has appointed Xavier Barcons, 57, as the next Director General of ESO. He will take up his position on 1 September 2017, when Tim de Zeeuw, the current Director General, completes his mandate.

"On behalf of Council, I am delighted to appoint Xavier Barcons as Tim de Zeeuw's successor as Director General," says Patrick Roche, President of ESO Council. "Xavier is ideally placed to lead the further development of the organisation in the next phase of its programme, including the construction of the European Extremely Large Telescope, the most powerful and ambitious telescope of its kind. We thank Tim for his exemplary leadership of ESO through a remarkably successful decade, which has firmly established ESO as the leading astronomical observatory on Earth."

Professor Xavier Barcons is Spanish and has had a distinguished career both in the academic world and also as an expert in science policy. He is also well known at ESO after his active and successful term as Council President between 2012 and 2014, a period that included the approval of the E-ELT Programme and the start of Phase 1 of the telescope's construction. He has also served as an active member and chair of many other ESO committees, most recently being chair of the Observing Programmes Committee.

Tim de Zeeuw comments: "I am very pleased to hand the baton to Xavier, who I have had the great pleasure of working closely with for many years. The scope of ESO's programme has expanded a lot and the future looks bright – ALMA is producing fascinating science, the E-ELT is under construction and new projects and Member States are on the horizon. But there are also undoubtedly many challenges to come, and I can't think of a better captain to steer the ship than Xavier!"

Xavier Barcons adds: "I feel very honoured to take on the leadership of ESO at this exciting time. During Tim's leadership, the organisation has flourished and grown. I look forward to seeing the E-ELT come to fruition and overseeing the further development of the Very Large Telescope, ALMA and many other projects at ESO. I also look forward to working with ESO's world-class staff." Xavier Barcons began his career as a physicist and completed his PhD at the University of Cantabria in 1985 on the subject of hot plasmas and the intergalactic medium. This led to an interest in X-ray astronomy and the study of the spectra of distant quasars. After a period working in Cambridge, UK, he returned to Spain and was instrumental in establishing the first X-ray astronomy group in his country. Since 2002 he has been Research Professor at the Spanish Council for Scientific Research (CSIC).

Xavier's subsequent research has focused on X-ray astronomy and he has used data from many space observatories, including Einstein, ROSAT and XMM-Newton, as well as arranging many coordinated ground-based observing campaigns at ESO and elsewhere. During the last 15 years, he has been promoting a next generation European X-ray observatory, now selected by ESA as the Athena mission. A particular area of scientific interest is the nature of active galactic nuclei in the distant Universe and how observing both from space and the ground can lead to a better understanding of their properties and evolution.

Xavier Barcons is married and has two children.

eso1643 – Organisation Release http://www.eso.org/public/news/eso1643/?lang

ROAD NEWS: ASTRONOMY in TAJIKISTAN: CURRENT ACTIVITIES

The **Institute of Astrophysics of the Academy of Sciences of the Republic of Tajikistan** is the center for astronomical science and training of highly qualified specialists of astronomy in the Republic of Tajikistan. It was established in 1958 on the basis of the Tajik Astronomical Observatory, which was founded in 1932.

The Institute of Astrophysics of the Academy of Sciences of the Republic of Tajikistan

The Institute has two modern astronomical observatories at different altitudes: **Gissar Astronomical Observatory (GissAO)** located in 14 km South-East from Dushanbe; the **International Astronomical Observatory of Sanglokh (IAOS)** (2300 m above sea level), which is located in Dangara district of the Khatlon region in the South-East of Dushanbe at a distance of 90 km, with its branch, **Astronomical Observatory of Pamir** in Murghab district of Badakhshan Region (4350 m above sea level).

Telescope AVR-2 (left) and AZT-8 (right) of GissAO

In **GissAO**, observations are made of comets and Near-Earth Asteroids (NEAs) using the telescopes AZT-8 (with a diameter of 70 cm), the 40-cm astrograph and AVR-2.

IAOS has a reflecting telescope with a diameter of 1m Zeiss-1000 and telescope Zeiss-600 with a diameter of 60 cm. In 2015-2016, the telescope Zeiss-1000 was restored and modernized. The telescope has worked after 26 years of interruption. The control of the movement of the telescope and observations are performed with the help of computers and special programs. Automatic pointing of the telescope at a specific object by giving the coordinates is being made. The connection of the telescope with a new camera, allowed us to obtain digital images of celestial bodies. By using of the camera, the power of the telescope has increased several times. The images can be immediately displayed on the PC monitor and are available for quick processing and obtaining results.

International Astronomical Observatory of Sanglokh (IAOS, left) and IAOS Zeiss-1000 telescope (right)

In addition to observations of Near-Earth Objects (NEOs), we have received the opportunity to photograph very faint and far objects, which are inaccessible for recording on ordinary photographic plates. Thus, after a 26-year break, we have received a new "First light" with the telescope of Zeiss-1000 of the IAOS. The telescope Zeiss-1000 has already performed observations of potentially hazardous asteroid 2016LX48, comets C/2014A4 (SONEAR), 56P/slaughter-Burnham, 174/Echeclus and asteroid (L4384)Henrybul, and for the first time, observations of selected objects were conducted in the geostationary region, i.e., located at a distance of 36 to 40 thousand miles from Earth. These are geostationary satellites and two small fragments of space debris.

The results of observations of asteroid 2016LX48 have been published in the **Circular of the Minor Planet Sciences (MPS)**, which indicates that they satisfy the standards adopted by the International Astronomical Union (IAU).

Gulchehra Kokhirova
Director, Institute of Astrophysics of the
Academy of Sciences of the Republic of Tajikistan

Firuza Rahmatullaeva
Scientific Secretary, Institute of Astrophysics of the
Academy of Sciences of the Republic of Tajikistan

INTERNATIONAL OLYMPIAD on ASTRONOMY AND ASTROPHYSICS

The **International Olympiad on Astronomy and Astrophysics (IOAA)** is an annual astronomy competition for high school students. It started in 2007 and it is one of the international science olympiads. The table shows all IOAAs held during 2007-2016 and the future planned ones.

Number	Year	Host country	Host city	Absolute winner	Countries Represented
1	2007	Thailand	Chiang Mai	THA Suwun Suwunnarat	21
2	2008	Indonesia	Bandung	IND Nitin Jain	22
3	2009	Iran	Tehran	IND Nitin Jain	20
4	2010	China	Beijing	POL Przemysław Mróz	23
5	2011	Poland	Chorzów / Katowice / Krakow	CZE Stanislav Fort	26
6	2012	Brazil	Rio de Janeiro / Vassouras	LTU Motiejus Valiūnas	28
7	2013	Greece	Volos	ROM Denis Turcu	35
8	2014	Romania	Suceava / Gura Humorului	ROM Denis Turcu	42
9	2015	Indonesia	Magelang / Semarang	INA Joandy Leonata Pratama	41
10	2016	India	Bhubaneswar	IND Ameya Patwardhan	42
11	2017	Thailand	Phuket	TBD	
12	2018	Sri Lanka	TBD	TBD	
13	2019	Hungary	TBD	TBD	
14	2020	Colombia	TBD	TBD	
15	2021	Serbia	TBD	TBD	

Typically an IOAA participant faces four exams:

- Theoretical Exam: consisting of 15 short questions and 2 or 3 long questions, with 5 hours to solve. It counts as 50% of the mark.
- Data Analysis Exam: a paper- or computer-based task for analysing actual data obtained from professional astronomers, with usually 4 hours to solve. It counts as 25% of the mark.
- Observational Exam: questions concerning direct observation of the sky (in the real sky or in a planetarium), recognizing stars, constellations, nebulae, great circles, etc. It counts as 25% of the mark.
- Team Competition: A separated competition, in which national teams are set to do a huge task, involving both individual and group efforts, with theoretical and /or practical reasoning.

The Armenian team has taken part in IOAAs since 2013 (in Greece). Compared to the International Astronomical Olympiads (IAO), our team has smaller number of medals and success, however it may be explained by less experience.

The 10th IOAA was organized on December 9-19, 2016 in Bhubaneswar, India. 42 teams participated, including the Armenian one led by Marietta Gyulzadyan, as during all Olympiads since 2006. **Ashot Matevosyan** from "Quantum" College was awarded a bronze medal, and Hayk Harutyunyan - Commendation.

SUMMARY of the ASTRONOMICAL YEAR 2016

A meeting summarizing the astronomical year 2016 took place at the Presidium of the National Academy of Sciences of the Republic of Armenia (NAS RA) on December 21, 2016. The Winter Solstice day was chosen on purpose, as well as the time of the meeting coincided with the exact moment, 14 minutes after the beginning, 14:44 Armenian time.

Haik Harutyunian (BAO Director) reported about most important BAO activities in 2016, while **Areg Mickaelian (ArAS Co-President and BAO Deputy Director on International Affairs)** summarized the most important events at the international level, as well as gave an overview on astronomical educational and public outreach events in 2016. He also briefly presented the calendar of astronomical events in 2017. Then a number of awards and presentations followed:

- **ArAS Annual Prize for Young Astronomers 2016** (Yervant Terzian Prize) was awarded to **Anahit Samsonyan**, young researcher from BAO

- **Galileo Teachers Training Program (GTTP)** international certificate was awarded to **Levon Aramyan** (for the creation of the 360 degree fulldome astronomical educational movie) and **Sona Farmanyan** (for the idea and organization of the Byurakan Science Camps in 2014, 2015 and 2016)

- **BAO-70 Scientific Journalism Prizes**: Arpi Jilavyan (Panorama.am; *for the best printed or online article*), Marianna Ghahramanyan (Ararat TV; *for the best TV or radio program*), and Ani Karapetyan (Asekose.am; *for the most active scientific journalist during 2016*)

- **Certificates to Mass Media** for active elucidation of astronomy to the public: "168 zham" (168.am) newspaper, "Tesaket" press-club and Tesaket.info information portal, "Armenpress" news agency, Marie Tarian for her *"Gitamard"* project ("Mediamax")

- Presentation of the just published **Proceedings of the Young Scientists Conference *"Cultural Astronomy in the Armenian Highland"*** held on 20-23 June 2016 in Yerevan, Armenia

- Presentation of the new **documentary film *"Byurakan Astrophysical Observatory"*** (in frame of the Astronomical Tourism project)

Let us remind that ArAS and BAO have awarded **Scientific Journalism prizes** also before, in 2009, 2011, and 2013. The **first Scientific Journalism prizes in Armenia** have been awarded in 2009 on the occasion with the **International Year of Astronomy (IYA-2009)**. Lusine Martirosyan ("Armenpress" news agency) was announced the most active scientific journalist in 2009 and Melanya Barseghyan ("Aravot" newspaper) won the prize for the best scientific paper. **ArAS/OxArm Popular Astronomy Prizes 2011** were awarded in 2011. They were jointly established by ArAS and the Oxford Armenian Society (OxArm, http://oxarm.com/Home.html). The Prizes intended to encourage popular astronomy publications and TV/radio programs in Armenia. The Prize for the most active journalist was awarded to Gohar Hakobyan ("Aravot" newspaper). She was not only active in her own publications during the whole 2011, but also she was editing the cultural-scientific section of the newspaper and followed all major scientific events in 2011. The Prize for the best newspaper/journal/online article was awarded to two journalists: Artur Hovhannisyan ("Hayacq") and Narine Ghazaryan ("Lragir"). The Prize for the best radio/TV program was awarded to Narine Sahakyan (H1 TV, for the film "Science on Mt. Aragatz slopes"). The Prize for the best astronomical photo was not awarded due to absence of nominees. In 2013, Certificates of Appreciation were awarded to a number of mass media and individual journalists, for the illustration of science.

ArAS ANNUAL PRIZE for YOUNG ASTRONOMERS (YERVANT TERZIAN PRIZE) 2016

The ArAS Prize for Young Astronomers was established in 2004 and is being sponsored by one of ArAS Co-Presidents *Prof.* Yervant Terzian (Cornell University, USA). Since 2009 the Prize is named after Yervant Terzian. The winners should be under 35 and they receive a Certificate and USD 500 sum. The Prize is being awarded to the most active young astronomer based on research papers, participation in conferences, delivered seminars, and other activities. Altogether, 12 young astronomers have been winners, including 3 from foreign countries (in some years the Prize was shared between two astronomers). Lusine Sargsyan, Vardan Adibekyan, Parandzem Sinamyan and Artur Hakobyan have become winners twice.

ArAS Annual Prize for Young Astronomers (Yervant Terzian Prize) 2016 was awarded to:

Anahit SAMSONYAN (BAO, Armenia)

Anahit SAMSONYAN was born on 07.05.1988 in Yerevan, Armenia. She graduated from the Yerevan State University (YSU) in 2010 with M.Sc. She joined BAO in 2009 working with *Dr.* Norair Melikian and later started to work with *Prof.* Daniel Weedman. Presently she is a Junior Research Associate. Her research interests include AGN and Starburst galaxies, particularly their study in IR, mainly using Spitzer IRS archival data. In 2016 Anahit showed high activity; she published a paper in ApJS, an electronic catalogue in Vizier, as well as two conference papers. Anahit was the Co-Chair of LOC of the 5th Byurakan International Summer School (5BISS) and a member of LOC of the International Symposium dedicated to the 70th anniversary of BAO. She is included in a Thematic Grant of the State Committee for Science of the Ministry of Education and Science of the Republic of Armenia led by *Dr.* Ashot Hakopian. In 2016, Anahit had a 1-month mission to Cornell University, N.Y., USA for research collaboration.

All ArAS Prize Winners:

2016 Anahit SAMSONYAN (BAO)
2015 Artur HAKOBYAN (BAO)
2014 Gurgen PARONYAN (BAO)
2013 Hayk ABRAHAMYAN (BAO) and Avet HARUTYUNYAN (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 HOVHANNESSIAN (BAO)
2004 Lusine SARGSYAN (BAO)

NEW GALILEO TEACHERS in ARMENIA

Galileo Teacher Training Program (GTTP) started in 2009 and was one of the International Year of Astronomy 2009 (IYA-2009) cornerstone projects aiming at creation of a worldwide network of certified “Galileo Ambassadors” and "Galileo Teachers". GTTP successfully continues after IYA-2009 in frame of the project Beyond IYA-2009 and is now an official educational program of the International Astronomical Union (IAU) and part of the "IAU Decadal Strategic Plan” in 2010-2020.

Galileo Ambassadors are equipped to train other teachers in these methodologies, leveraging the work begun during IYA2009 in classrooms everywhere. The GTTP Armenian Ambassador is *Dr.* Areg Mickaelian. In addition, *Dr.* Marietta Gyulzadyan is the GTTP Armenian Coordinator.

Galileo Teachers receive training in the effective use and transfer of astronomy education tools and resources into classroom science curricula and disseminate this knowledge among their peers. Through workshops, online training tools and basic education kits, the pro-ducts and techniques developed by this programme can be adapted to reach locations with few resources of their own, as well as computer-connected areas that can take advantage of access to robotic optical and radio telescopes, webcams, astronomy exercises, cross-disciplinary resources, image processing and digital universes (web and desktop planetariums). It is supposed that Galileo teacher uses new methods in astronomy education and train other teachers sharing their knowledge.

In 2016, the new Galileo Teachers in Armenia were recognized and GTTP certificates were awarded to:

Levon ARAMYAN (BAO and Technology and Science Dynamics, Armenia)
for the creation of the 360 degree fulldome astronomical educational movie

Sona FARMANYAN (BAO and NAS RA)
for the idea and organization of the Byurakan Science Camps in 2014, 2015 and 2016

Galileo Teachers in Armenia:

2016 Sona FARMANYAN (BAO, NAS RA)
2016 Levon ARAMYAN (BAO)
2015 Hayk ABRAHAMYAN (BAO)
2014 Sergey NERSISYAN (Armenian State Pedagogical University)
2014 Ashot HAKOBYAN (BAO)
2013 Robert SARGSYAN (Basic College of Armenian State Agrarian University)
2012 Avetik GRIGORYAN (Armenian Youth Aero-Space Club, AYAS)
2011 Tigran NAZARYAN (BAO)
2011 Marietta GYULZADYAN (BAO and Yerevan Physics-Mathematics School)

PUBLICATION of the PROCEEDINGS of CONFERENCE "CULTURAL ASTRONOMY in the ARMENIAN HIGHLAND"

The Proceedings of the meeting *"Cultural Astronomy in the Armenian Highland"* have been published by the Armenian National Academy of Sciences *"Gitutyun"* Publishing House. The editors are S. V. Farmanyan, Yu. M. Suvaryan, and A. M. Mickaelian. The book has 250 pages and includes invited and contributed talks, as well as Preface giving general information on the meeting and its main events, lists of organizers and participants. It contains 29 articles and consists of 4 main sections: "Introductory Talk", "Cultural Astronomy", "Archaeoastronomy", "Scientific Tourism and Journalism, Astronomical Education and Amateur Astronomy". The book may be interesting to astronomers, culturologists, philologists, linguists, historians, archaeologists, art historians, ethnographers and to other specialists, as well as to students.

The meeting was aimed at the development of problems of interdisciplinary sciences in Armenia and preparation of a basis for further possible collaborations by means of presentations of available modern knowledge in various areas of science and culture by experts from different professions and by joint discussions.

A number of **thematic sessions** were held:

- Cultural Astronomy
- Archaeoastronomy
- Scientific Tourism & Scientific Journalism
- Astronomical Education & Amateur Astronomy

Invited and contributed talks were presented by renown and young researchers. The present Proceedings includes most of the talks. We hope that the Proceedings will be an interesting and valuable resource for many professionals and broad mass of readers.

Sona Farmanyan, Yuri Suvaryan, Areg Mickaelian
(Editors)

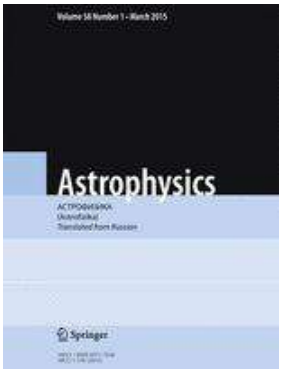
MARIETTA GYULZADYAN's 60th ANNIVERSARY

Dr. Marietta GYULZADYAN, celebrated recently her 60th anniversary. 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. In 2015, she 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. Her Olympic 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)
2016 IAO-XXI - 1 Bronze medal (Areg Grigoryan)
2016 IOAA-X - 1 Bronze medal (Ashot Matevosyan)

As a result, Armenian teams led by Marietta during 2006-2016 have won 6 Gold, 3 Silver and 22 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.

RELEASE OF *ASTROPHYSICS* 2016 DECEMBER ISSUE



Journal ***Astrophysics*** **Volume 59 Number 4** was recently released and is now available online.

The Contents of this issue:

Dependence of the Spin of Supermassive Black Holes on the Eddington Factor for Accretion Disks in Active Galactic Nuclei
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Modelling the Gas Dynamics of Protoplanetary Disks by the SPH Method
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The N/O Ratio in Early BType Main Sequence Stars as an Indicator of Their Evolution
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Origin of the Blue Continuum Radiation in the Flare Spectra of dMe Stars
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New Emission Stars in B Cyg OB7
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Difficulties in Estimating the Physical Parameters of Compact Radio Sources in Active Galactic Nuclei
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RELEASE of ASTROCOURIER NOVEMBER and DECEMBER ISSUES

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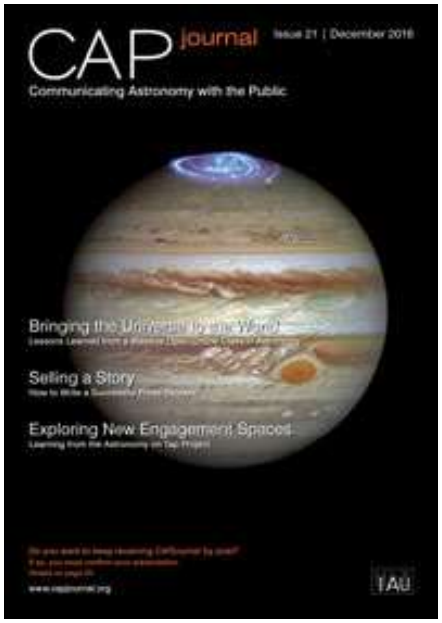
RELEASE OF THE IAU ASTRONOMY OUTREACH NEWSLETTER 2016 DECEMBER #1 and #2

December #1 Contents:

December #2 (2016-2017 Special Edition) Contents:

RELEASE OF CAP JOURNAL DECEMBER ISSUE

CAP (Communicating Astronomy with the Public) journal Issue 21 December was released and is available at http://www.capjournal.org/issues/21/



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