ArAS News

NEWSLETTER

ARMENIAN ASTRONOMICAL SOCIETY (A r A S)

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ESTABLISHMENT AND ACTIVITIES OF THE REGIONAL ASTRONOMICAL CENTER IN ARMENIA

The International Astronomical Union's (IAU) Office of Astronomy for Development (OAD) has established South West Asian (SWA) OAD office in Armenia. The Armenian office is hosted by Byurakan Astrophysical Observatory and coordinates astronomy for development activities in Armenia and nearby countries, thus realizing the IAU Strategic Plan and implementing the relevant functions.

At the Opening Ceremony Radik Martirosyan, President of the National Academy of Sciences of the Republic of Armenia gave a welcoming address; other talks were given by IAU General Secretary Piero Benvenuti, IAU OAD Director Kevin Govender, Director of Byurakan Astrophysical Observatory Haik Harutyunian, Astronomy for Development IAU Strategic Plan 2010-2020 Coordinator George Miley and IAU SWA ROAD Director Areg Mickaelian. The event was attended by the representatives of the regional countries, the participants of the Iranian-Armenian conference, ambassadors, and the representatives of cultural, scientific and educational communities.

Just after the establishment of the office, the SWA ROAD organized its first workshop; among the participants were IAU and IAU OAD Officers, and the representatives of other regional countries.

Also the first Armenian-Iranian Astronomical Workshop was organized. The meeting was fruitful one, as the Armenian and Iranian scientists discussed joint scientific projects, and established the Armenian-Iranian cooperation.

South West Asian Regional Office of Astronomy for Development

ASTRONOMICAL SURVEY AND BIG DATA

"Astronomical Surveys and Big Data" meeting dedicated to 50th anniversary of Markarian Survey and 10th anniversary of the Armenian Virtual Observatory (ArVO) was held on Oct 5-8, 2015 in Byurakan, Armenia. We have combined astronomers and computer scientists with heavy involvement of astronomical surveys, catalogs, archives, databases and VOs.

Our meeting has contributed to the following:

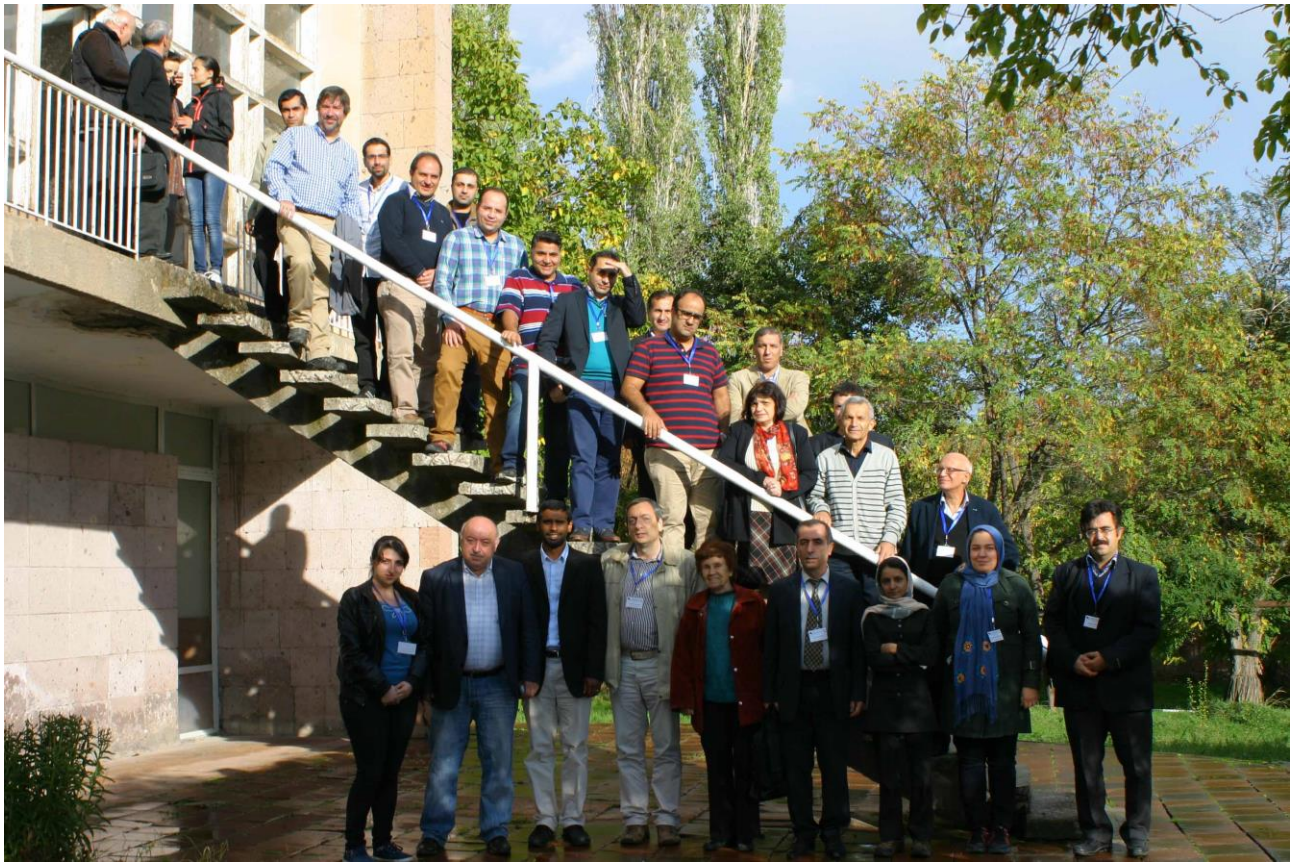
- Review and discuss large astronomical surveys to summarize observational data obtained in astronomy
- Give tribute to Markarian Survey and other important surveys
- Review and discuss astronomical catalogues, databases and archives
- Learn about major upcoming surveys (including PanSTARRS, Gaia, and LSST)
- Learn and discuss how large observational data sets are changing astronomy
- Introduce tools and techniques for working with large data sets (including access, analysis, and visualization)
- Discuss the future of astronomical research by joint efforts of astronomers and computer scientists

The Symposium was dedicated to Markarian Survey 50th anniversary. Benyamin Markarian (1913-1985) was the first to conduct and accomplish a large-area (17,000 sq. deg.) spectroscopic survey in 1965 to search for active galaxies. Markarian survey is until now the largest objective-prism spectroscopic survey, it was the first systematic search for active galaxies using a new method of UV-excess, it resulted in the discovery of 1515 UVX galaxies (Markarian galaxies), including many AGN and Starbursts, first classification of Seyferts into Sy1 and Sy2, and definition of Starburst galaxies. BAO is famous for other surveys as well: Arakelian and Kazarian galaxies, Shahbazian compact groups, Parsamian cometary nebulae and other objects also are well known. Byurakan is a right place for organization of such meeting.

The **Proceedings** will be published by Astronomical Society of the Pacific (ASP) Conference Series. Areg Mickaelian, Andy Lawrence and Tigran Magakian are the editors. The deadline for submission of papers is 15 December 2015. Registration fee includes a copy of the Proceedings book. Page limits: Invited talks – 10 pages, Contributed talks – 7 pages, Posters – 3 pages.

Areg Mickaelian, Chair of SOC and Co-Chair of LOC

Group photo of the symposium "Astronomical Surveys and Big Data".



Group photo of Armenian-Iranian Astronomical Workshop.

ARMENIAN-IRANIAN ASTRONOMICAL WORKSHOP

Armenian-Iranian Astronomical Workshop was held on Oct 13-16, 2015 in Byurakan, Armenia. We have established mutual contacts, discussed and conducted joint research projects, which gave start to Armenian-Iranian astronomical collaboration, these included several forms of relations:

- organization and participation in regional activities;
- collaborative research grants between Armenian and Iranian scientific groups;
- stays of Armenian scientists at Iranian institutions for joint research work;
- stays of Iranian scientists at Armenian institutions for joint research work;
- stays of young Armenian scientists for training and fulfillment of Ph.D. theses;
- stays of young Iranian scientists for training and fulfillment of Ph.D. theses;
- organization of joint meetings in frame of the collaboration;
- Byurakan International Summer Schools (BISS) with invitation of Iranian students;
- observations on joint projects with the Byurakan 2.6m telescope;
- collaboration between the Armenian and Iranian Virtual Observatories;
- joint archaeoastronomical and cultural studies.

Armenia and Iran are among the most ancient countries in the world and have lived as neighbours through thousands years of history. Armenian and Iranian culture has many similarities and relations. During the recent years, tight relations are being established in more and more spheres, including politics, economy, tourism, sports, culture and indeed science. This Workshop was for strengthening our scientific relations and establishing new collaboration. We plan to organize such workshops on annual basis, succeeding each other one in Armenia and one in Iran.

Such joint workshops have been organized with Georgian colleagues since 1974 and proved to be rather useful. We also have organized two joint Armenian-French workshops in 1995 and 2009, as well as several others, including with Russian colleagues from Saint Petersburg and Moscow.

The **Proceedings** will be published by BAO. Haik Harutyunian, Habib Khosroshahi and Areg Mickaelian are the editors. Deadline for submission of papers is 15 December 2015. Page limits: Invited talks – 8 pages, Contributed talks – 5 pages, Posters – 2 pages.

Areg Mickaelian, Co-Chair of SOC and Co-Chair of LOC

SECOND BYURAKAN SCIENCE CAMP

Byurakan Astrophysical Observatory (BAO) and **Armenian Astronomical Society** (ArAS) with the sponsorship of the **Fund for Armenian Relief** (FAR) organized the Second Byurakan Science Camp on October 26-30, 2015 at BAO. During these days, pupils accompanied by the organizers and Byurakan young astronomers stayed at BAO hotel and benefited the science atmosphere and contacts with scientists, as well as had active rest.

Ten members were engaged in the execution of the project, mostly young fellows of BAO. All duties were distributed among the team, so that each person took care for a definite task.

Local Organizing Committee (LOC)

Director of the Science Camp and Chairman of LOC: Dr. Areg Mickaelian
Coordinator of the Science Camp: Ms. Sona Farmanyan
LOC Members: H. Abrahamyan, N. Azatyan, M. Alexanyan, S. Farmanyan, K. Gigoyan, M. Gyulzadyan, H. Melkumyan, G. Mikayelyan, G. Ohanyan, G. Paronyan, M. Zohrabyan.

Target group was 12-15-year-old pupils; they were selected by the directors of schools. In addition, the organizers had individual interviews with these potential participants. The selection criteria of pupils were according to their interest of Astronomy, Physics and Mathematics. The participants were from State Engineering University of Armenia (SEUA) high school, AYB college, Byurakan secondary school, and others.

Program and Events

The Science Camp had rather rich program, including Scientific, Educational and Social ones. A number of lectures were given on various topics of Astronomy by BAO scientists, observations and tutorials were organized. Various meetings and discussions, intellectual and sports games, social tours were organized as well.

The Science Camp really succeeded, we got gratitude words from schools' directors, parents and campers. Most of the campers admired by the mysteries of the Universe and decided to choose astronomy as their future profession. Campers also gave willingness to help organize future science camps and figure as volunteers. We created a mailing list of all participants for future contacts and communications. All they became friends and share information on social networks.

Dr. Areg Mickaelian, Director, BAO Science Camp
Sona Farmanyan, Coordinator, BAO Science Camp

Interview Finding the first exoplanet, 20 years on

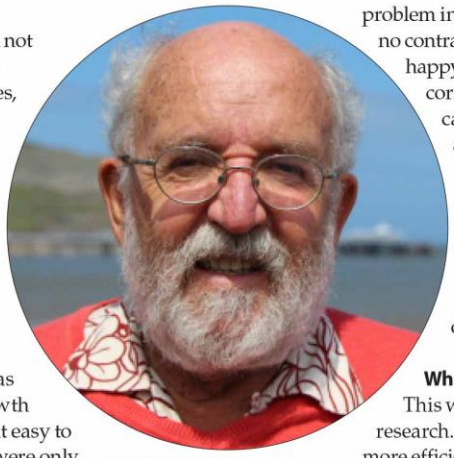


PHOTO CREDIT?????

Michel Mayor was awarded the RAS Gold Medal for Astronomy this year. Sue Bowler discusses his career since he and Didier Queloz discovered the first exoplanet around a normal star – a Jupiter-mass planet around 51 Pegasi – 20 years ago.

Were you interested in science as a child?
I was always interested in science, but I did not dream of being an astronomer. I was fascinated by every domain of science: volcanoes, oceanography, geophysics, geology, the Alps… I loved mathematics so I chose to study physics and maths at the University of Lausanne. After the first year I had to choose between them and I chose physics – theoretical physics. I continued with a masters degree and studied interactions of particles with large spin.

How did you become an astronomer?
When I completed my masters degree it was the late sixties, when there was a huge growth in people working in research. This made it easy to move into new domains of science. There were only two theoretical physics masters graduates at Lausanne; we saw two adverts for PhD positions, one in statistical mechanics and one in astrophysics. We each picked the one that seemed most interesting. I started my research in astrophysics at the University of Geneva, working on the spiral shapes of galaxies. The origin of this structure had been a long-standing problem: if it was a result of strong differential rotation, as it appeared, then such galaxies would not keep their shape, but would wind themselves up. Lin and Shu had recently proposed a theoretical explanation; I wanted to test the consequences of their idea on local velocity fields, to see how they perturbed the mean flow of stars. This was the start of my interest in stellar kinematics.

What took you into instrumentation?
By the end of my PhD I was looking for observations to test these ideas, but the star velocities in catalogues were not good enough. I needed new data. By chance, at an N-Body Colloquium on small cluster interactions in Cambridge, I met Roger Griffin and we talked about a new spectrographic method to measure stellar velocities by cross-correlation (Griffin 1967). I realized that this was what I needed to get my data. Back in Geneva, I discussed it with the director, who was in favour of this as a way to develop the observatory. But I think he wondered how I, a theorist, would fare building an instrument.

How did you get on?
The problem with building instruments is that, when you look at a book of designs, each one looks perfect until you see the next! I needed advice and André Baranne, a very good optics engineer at Marseille Observatory, provided it. In fact, he found the problem interesting so he designed it for me – we had no contracts, no money changed hands. I was very happy with the result. This was my first cross-correlation spectrograph, with more technical possibilities than Roger had envisaged and with a new computer that made it very efficient. We built two instruments, installing the first at Marseille Observatory in 1977. I was in the dome on the first night the instrument was working and it was fascinating to see what it could do – we got a huge reward for taking the risk of building something new.

What did you do with the new instrument?
This was the start of a huge period of kinematics research. Our new instrument was about 4000 times more efficient than working with photographic plates. I studied the cepheids in the Magellanic Clouds, and worked on the statistical properties of binaries and solar-type stars. I spent about 15 years examining the distance/mass ratio and eccentricity of these stars. This looked a bit like old astronomy but, in fact, it gave me my most cited paper – more than the 51 Peg paper. I wanted to extend this work to examine the distribution of mass ratios for objects of the mass of the Sun and below, to include brown dwarfs and possibly even planets, but the data we had were not good enough. The instruments could resolve radial velocity variations down to 300 m s^{-1}, which was too high to pick up the effects of these smaller bodies.

The director of the Haute Provence Observatory in effect solved the problem by asking Baranne and me to develop a new spectrograph, incorporating new technology, CCDs, optical fibres – all sorts of developments not available 20 years before. This we did: ELODIE was a huge success from 1993 onwards, resolving velocity variations down to 10–15 m s^{-1}, a factor of 20 or 30 better than before.

What did you do next?
I set out to sample 142 solar-equivalent stars and make systematic measurements to look for any wobble. I had two goals: a search for brown dwarf companions to stars like the Sun, and a search for giant planets. But I had no *a priori* expectation of what we would find. No-one predicted planets with periods measured in days – theory suggested that giant gas planets would have orbital periods of at least 10 years, so I wasn't expecting any imminent results.

At the start we found several stars with variable velocities and we had to check for other possible causes of irregularity such as changing magnetic fields. One star – 51 Pegasi – appeared to have no

magnetic field, but the signal suggested a planet with a period of 4.5 days and a mass half that of Jupiter. This was so unexpected that we waited an additional season to check that the period and the phase were consistent and that we got the same amplitude. We had found a planet with a period of four days rather than the 10 years everyone expected – a factor of 1000 out! We had checked carefully to be sure – it was so close to its star we wondered if the orbit would be unstable, for example, but found no signs. By July 1995, we had such consistent data that we rushed to write the paper [Mayor & Queloz 1995] and submitted it to *Nature*, because it looked interesting.

What happened when you published?

I spoke about the work at the Cool Stars workshop in Florence in the first week of October 1995. Right away, we were on Italian TV and after that we lost control. There was a huge amount of interest from TV and newspapers – the BBC even produced a 50-minute documentary focusing on the Haute Provence Observatory. We expected the interest to decline, but then in 1996 Geoff Marcy announced the discovery of two more planets, of even smaller mass, and the press attention continued. I'm not complaining about this success, but the number of conferences, workshops and public lectures became a problem! At conferences I went from going into a room of 300 people and knowing 20, to knowing all of them, in just one year.

"I am looking forward to huge progress in transmission spectroscopy"

What has changed over the past 20 years?

It is easy to get the impression that everybody knew that there were many planets beyond our own system, but if you check the literature it's a different story. In the early 20th century there were papers by James Jeans, Fred Hoyle, Shapley Curtis and others saying that there were no or very few other planetary systems. From Laplace and Jeans came the idea of a solar nebula, but the only mechanism to form planets involved two stars passing very close to each other and producing a disc. This had a very low probability and so discs – and planets – were thought to be rare over the lifetime of the galaxy.

In 1943, astronomers thought they had detected two planets around a nearby star, which changed the odds at once. If there were planets to be found around a star near Earth, then it was likely that there would be a lot of planets across the galaxy. However, the discovery was a mistake. By around 1952, there was the realization that discs would form during the collapse of a giant molecular cloud if there was excess angular momentum in the system. Discs then became a normal by-product of collapse, because there always was excess angular momentum. And if discs were not so special, then planetary systems should be expected. The idea that planetary systems should be common started then, around 60 years ago; before then the idea belonged to science fiction.

How has the science changed?

Looking back on how knowledge has developed since we discovered 51 Peg b, I have great satisfaction at how the field has developed. In 1995, nobody expected to detect such a short-period planet, but now we have a great diversity of planetary systems. I'm also impressed with the observational data on planetary migration. Migration had been predicted as an important process in planetary formation by Goldreich & Tremaine (1980), who said that Jupiter was not born where it is today in relation to the Sun; later work, including that by John Papalouziou, has also cited orbital migration as an important part of the process of planet formation.

What about the future?

I am looking forward to huge progress in spectroscopy of planets, especially transmission spectroscopy. If you examine the spectra of a star–planet system when the planet is behind the star, you record the spectrum of the star only; if you take data when the planet is in front of the star you can find the planet's spectrum by subtraction; and if you measure the spectrum as the planet moves across the star, you can pick out how the planet's atmosphere filters the starlight and measure the elements present. You need a lot of photons to do this, and that means big telescopes. We already have some capability in Paranal, but the 39 m E-ELT will transform the field. With it we can measure transit size, Doppler mass, and hence bulk density for a whole range of planets.

One current project at Geneva is to try to build a small catalogue of bright stars with planets, in order to identify stars that are very close to us with small planets orbiting with periods of about a year. We are building for the future – it's an input catalogue for the next generation of missions to explore planets like Earth. If we were ever to build an ambitious mission, perhaps an interferometer like Darwin, we want to have a list of likely places to look.

We also have to think about new instruments. I was influenced by the theoretical work of Peter Fellgett who, in 1953, proposed the mathematical basis of a cross-correlation spectrograph. He showed that it is possible to extract Doppler information by cross-correlation, but very few people read his paper. And in the past 20–30 years spectroscopic technology has improved by a factor of 1000, from a resolution of about 300 m s^{-1} to about 0.3 m s^{-1}. At this level, the most important variation comes not in the instrument but in the star itself: spots, granulation and star cycles can all cause problems in determining if a planet is present. We need a strategy to take it into account. Even if you can design a device to get 2 cm s^{-1}, which should make planets easier with a signal 10 or 100 times the noise, the problem of star variation remains.

How has your work changed?

The biggest change for me has been the number of young researchers working in completely new areas that did not exist 20 years ago – people looking for moons of planets, examining their atmospheres etc.

I'm very lucky to have been able to put my finger into this new domain of science. I've been lucky to be a professor at the University of Geneva for so many years and now to be emeritus professor there. That is more than a title: it gives me an office, research money and PhD students if I want to carry on with my research – and I do.

AUTHOR
Sue Bowler is editor of *A&G*.

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Griffin R F 1967 *Astrophys. J.* **148** 465
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Mayor M & Queloz D 1995 *Nature* **378** 355

RELEASE OF IAU ASTRONOMY OUTREACH NEWSLETTER 2015 #15

In this newsletter:

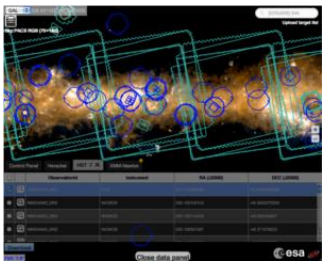
1. **From the Editors**
2. **Last chance to vote in the NameExoWorlds contest**
3. **Communicating Astronomy with the Public Journal — Issue 18**
4. **IAU National Outreach Contact Corner: News from Ghana**
5. **HighLIGHT of the Month: Supporting schools through Telescopes4Teachers**
6. **CosmicLight around the world**
7. **GalileoMobile releases its third documentary Ano-Luz (Light-year)**
8. **FREE online astronomy workshop for teachers (in French)**
9. **PhysicsHack Crowdfunding Hackathon**
10. **Upcoming meetings & global events around the world**
11. **Contributions to this newsletter**

RELEASE OF IVOA NEWSLETTER OCTOBER ISSUE

IVOA NEWS

China-VO enabled Popular Supernova Project
ASTERICS Virtual Observatory School
WWT Guided Tour Design Competition

VO APPLICATIONS AND IMPLEMENTATION HIGHLIGHTS



ESA Sky: the ESA Astronomy Multi-Mission Interface
The Keck Observatory Archive
TAO v2.0: The Theoretical Astrophysical Observatory
TOPCAT TAP Improvements

SOME RECENT PAPERS ABOUT VO-ENABLED SCIENCE

Featured Science Publication
Refereed Publications

VO CALENDAR

IVOA Newsletter is available at:
http://ivoa.net/newsletter/015/

James HOUCK – 75

Recently *Prof.* James Houck celebrated his 75th anniversary. He is the Principal Investigator for the Infrared Spectrograph (IRS) instrument on Spitzer, the Space Infrared Telescope Facility formerly called SIRTF. Spitzer was launched on August 25, 2003, and is the fourth and last of NASA's Great Observatories, the others being Hubble Space Telescope (HST), Gamma Ray Observatory (GRO), and Advanced X-ray Astronomy Facilities (AXAF).

The IRS, which is the most used instrument on Spitzer, has been working for six years now. Members of the IRS team have published over seventy refereed papers from the data obtained from Spitzer in addition to numerous U.S. and international conference and workshop presentations. Jim's current research with it focuses on the mechanisms responsible for energy generation in ultraluminous infrared galaxies and the formation of dust in the early Universe. Recent results have shown that the most luminous sources typically contain a combination of an active galactic nucleus (AGN) and a nuclear or extended starburst. Galaxy collisions or mergers are often associated with these sources. He is involved in a number of galactic programs including the imaging of circumstellar dust shells around evolved stars, and infrared spectroscopy of planetary nebulae and recent novae.

In addition to IRAS and IRS, Jim also led the Cornell development of the state-of-the-art instrumentation for the 5-meter telescope at the Palomar Observatory. The first major instrument developed at Cornell for this site was SpectroCam, a thermal infrared camera and spectrograph operating near the diffraction limit of the telescope.

Jim was awarded the 2008 Joseph Weber Award for Astronomical Instrumentation from the American Astronomical Society. The citation states: "This award was given to Dr. James Houck (Cornell University) for his extraordinary contributions over nearly four decades to major instrumentation for infrared astronomy. From early pioneering rocket experiments and major contributions to IRAS instrumentation to most recently the design and construction of IRS for the Spitzer telescope, Dr. Houck's contributions have been seminal to making infrared astronomy among the most exciting in the entire field. Scientifically, Dr. Houck's contributions have spanned the range from HII regions to the Galactic Center to extragalactic IR sources. It is no exaggeration to say that without Dr. Houck's contributions, modern IR astronomy would never have reached its current level of maturity."

NASA has recognized Jim twice with one of its top honors, the Exceptional Scientific Achievement Medal. In 1984 he received it "for outstanding contributions to IRAS, including efforts in the rebuilding of the telescope focal plane assembly and continuing scientific analysis," and in 2005 for leading the successful development of the Spitzer Space Telescope's infrared spectrograph.

For more information, please visit Prof. Houck's personal webpage:
http://astro.cornell.edu/members/james-r-houck.html

Milcho TSVETKOV – 75

Recently *Prof.* Milcho Kirilov Tsvetkov celebrated his 70th anniversary. He is an Associate Professor at Institute of Mathematics and Informatics of Bulgarian Academy of Sciences and the Head of Sofia Sky Archive Data Center and Wide-Field Plate Database (WFPDB) Project Manager. He was born on October 15, 1945, Sofia, Bulgaria. In 1971 he graduated from Sofia University "St. Kliment of Ohrid", specialty of astronomy. In 1976 he received Ph.D. in Physics and Mathematics at Yerevan State University and in 1985 he received Habilitation in Astronomy at Bulgarian Academy of Sciences (BAS), Institute of Astronomy. He worked at Department of Astronomy, BAS in 1971-1972, at Byurakan Astrophysical Observatory, Armenia in 1972-1976, at Institute of Astronomy, BAS in 1976-2012 and at Institute of Mathematics and Informatics, BAS in 2012-2015.

He has had a number of administrative appointments as well: 1979-1983 – Deputy Director of the National Astronomical Observatory, BAS, 1983-1988 – Scientific Secretary of the Department of Astronomy, BAS, 1983-1988 – Scientific Secretary of the National Committee of Astronomy, BAS, 1985-2000 – Member of the Scientific Council of the Department/Institute of Astronomy, since 1995 – Head of Wide-Field Plate Database, Institute of Astronomy, BAS, since 2000 – Head of the Sofia Sky Archive Data Center, Space Research Institute, BAS, 2002-2006 – National Representative of the EC COST Action 283, Space Research Institute, BAS, Ministry of Education and Science, Bulgarian Government, since 2008 – National Representative of the EURO VO Data Center Alliance, Institute of Astronomy, BAS, since 2011 – Head of the Laboratory "Astroinformatics and Virtual Observatory" at the Institute of Astronomy and National Astronomical Observatory, BAS, since 2013 – Associate Member of the Project Astroinformatics, Institute of Mathematics and Informatics, BAS. His professional appointments were: 1971-1972 – Research Assistant, Department of Astronomy, BAS, 1972-1976 – Post-graduate Student in Byurakan Astrophysical Observatory of the Armenian Academy of Sciences, Armenia, 1976-1985 – Scientific Associate of the Department of Astronomy and Rozhen Astronomical Observatory, BAS, 1985-1991 – Senior Research Associate of the Department of Astronomy and Rozhen Astronomical Observatory, 1991-present – Senior Research Fellow at the Institute of Astronomy, BAS, 1993-present – Founder and Principal Investigator of the Wide-Field Plate Database, Institute of Astronomy, BAS, 1995-present – Associate Professor in the Institute of Astronomy of BAS, 2000-present – Founder and Principal Investigator of the Sofia Sky Archive Data Center, and Wide-Field Plate Database, Institute of Astronomy, and Institute of Mathematics and Informatics, BAS.

Prof. Tsvetkov's major fields of scholarly interest are: Astronomy and Astrophysics, Flare Star Search in Stellar Aggregates, Large Databases, Data Mining, Image Processing, Archiving of Photographic Observations and Virtual Observatories. He has more than 220 publications.

He is member of IAU since 1976, Union of Scientists in Bulgaria since 1985, Alexander von Humboldt Fellow since 1988, Bulgarian Association of Pattern Recognition since 1991, European Astronomical Society (founding member) since 1991, Humboldt Union in Bulgaria (founding member) since 1992, American Association of Variable Stars Observers since 1996, ArAS since 2009 and Bulgariana (founding member) since 2014.

For more information, please visit Prof. Tsvetko's personal webpage:
http://wfpdb.org/team/milcho/

NOVEMBER CALENDAR OF ASTRONOMICAL EVENTS