



## Fall 2014 Newsletter

Ernie Malamud, Editor

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**Disclaimer—The articles and opinion pieces found in this issue of the APS Forum on International Physics Newsletter are not peer refereed and represent solely the views of the authors and not necessarily the views of the APS.**

## Remarks by the APS Director of International Affairs

*Amy Flatten*



I often use my articles for the Forum on International Physics (FIP) newsletter to encourage FIP members to apply for our travel grants and lectureships. On that note, I am delighted to inform you that we will issue calls for proposals over the next few months for:

- 1) the Brazil-U.S. Exchange Program,
- 2) the India-U.S. Travel Program, and
- 3) the International Travel Grant Award Program.

Information on these awards is available on our website: <http://www.aps.org/programs/international/honors/index.cfm>. We hope that you will apply for these wonderful opportunities.

For this article, I especially welcome the chance to inform the FIP members of an exciting new initiative, led by the APS Office of International Affairs--The "U.S.-China Young Physicists Forum" (YPF) that will be held February 28 and March 1, 2015, in San Antonio, Texas. The event is cosponsored by the American Physical Society (APS) and the Chinese Physical Society (CPS) as part of a larger effort to strengthen communication and collaboration between the U.S. and Chinese physics communities.

Leaders of both APS and CPS have underscored the importance of building connections among younger scientists, and have been working to build joint programs for graduate students from their respective countries. The APS March Meeting, which attracts 9,000-10,000 physicists worldwide, provides an ideal venue for bringing together graduate students from the United States and China for a combination of scientific-focused sessions with career development and networking opportunities. As many graduate students from China will already plan to attend the 2015 March Meeting in San Antonio, Texas, APS and CPS will

hold the U.S.-China YPF the weekend before the 2015 March Meeting begins. The program will especially encourage participation by U.S. graduate students who have had little or no experience in China.

The U.S.-China YPF will span a day and a half, with approximately 30 graduate students from each country (~60 total). It will be modeled after the biennial Canadian-American-Mexican Physics Graduate Student Conferences (CAM) that APS has co-sponsored since 2003, with the help of funding from the National Science Foundation. The scientific sessions will focus upon two of the major physics sub-disciplines addressed at the March Meeting: Condensed Matter Physics and Materials Physics.

The U.S.-China Young Physicists Forum (YPF) will combine scientific sessions with career development and networking opportunities for the graduate students, with each country sending ~30 students (~60 total for this meeting).

Through special topical and technical sessions, it will provide graduate students from the United States and China with:

- plenary physics sessions from US and Chinese senior scientists
- research presentations by participating U.S. and Chinese students during parallel and poster sessions
- career development discussions on publishing in peer-reviewed journals and careers outside of academia
- networking and social events with leaders in Condensed Matter Physics, Materials Physics, and VIP's from the APS and CPS

The program especially encourages U.S. graduate students without much prior experience in China to participate in the meeting.

Much like the CAM conferences, senior physicists will present their research in Condensed Matter Physics and Materials Physics, followed by parallel sessions with the graduate students themselves presenting to each other. A poster session and networking reception will allow students to discuss their research in smaller,

*(Continued on page 3)*

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more intimate settings than the larger March meeting would allow and share interests with not only their international peers, but also with leaders in Condensed Matter Physics, Materials Physics and dignitaries from APS and CPS. All graduate students will be expected to participate scientifically, either through presenting their research during a parallel session, or presenting a poster during the poster session/networking event.

APS 2015 Vice President Laura Greene will provide a session on “Publishing in Peer-Reviewed Journals,” a session that she has given to international audiences of young scientists around the globe. In addition to the scientific presentations and poster session, two panel discussions focused upon professional development and career-building will be tailored to both U.S. and Chinese graduate student interests. These include: “Careers Outside of Academia in the U.S. and China,” and “Life as a Graduate Student in the U.S. and China.”

The plenary and parallel scientific sessions will provide the YPF participants with an expanded view of physics beyond their own classrooms, laboratories, and nation. The panel discussions and networking opportunities will broaden their perspectives on career opportunities outside of academia, and will allow deeper insights into each country’s scientific culture and approaches toward scientific research or partnerships.

Likewise, the relationships formed at this conference have the potential to last throughout the participants’

professional lives. As the YPF participants will have already begun attending the annual APS March Meeting, they are likely to maintain connections over the years, as they continue to attending these APS meetings, and other international conferences in Condensed Matter Physics and Materials Physics. Consequently, the YPF has the potential to lead to many fruitful interdisciplinary and/or international networks and collaborations throughout the participants’ careers.

Through this combination of scientific, career development and networking opportunities, the U.S.-China Young Physicists Forum will foster an appreciation for international scientific collaboration among young physics researchers, and promote long-term connections among graduate students from the two countries. These early insights will prepare both U.S. and Chinese physics students for future scientific leadership and international scientific cooperation.

More information regarding participation, registration, abstract submission and the program will be available at [www.aps.org/international](http://www.aps.org/international). In the meantime, I would like to ask the members of FIP to share news of the U.S.-China Young Physicists Forum with their colleagues in Condensed Matter Physics and Materials Physics, and to encourage graduate students in these sub-disciplines to participate.

*Dr. Amy Flatten is Director of International Affairs at the American Physical Society*



## Trials and Tribulations of your FIP Editor

*Ernie Malamud*

**Why produce a newsletter?** In this time of information overflow is a periodic newsletter really necessary? All of us, professional researchers and educators have long “to-do” lists and a 20- or 30-page newsletter that only reaches us through an email announcement of its existence is often overlooked.

Is the newsletter worth the considerable effort required by the authors and Editor?

**Issues and deadlines.** There are 2 FIP newsletters per year (FIP bylaws Article IX-4). I have set the deadline for the spring issues enough in advance of the APS spring meetings so that copies (both on line and a few printed) are available at the meetings. Part of the spring issue contents is an encouragement to those attending either spring meeting to attend the FIP sessions. Consider the spring issue deadline to be “hard.”

**Spring 2015 Deadline. February 1, 2015. I will only include material received by that date!**

If you can, please send text in MSword format and graphical material as JPGs.

There is no “hard” deadline for the fall issue. However, I would like to space the issues roughly 6 months apart.

This fall 2014 issue has slipped several weeks for a variety of reasons. Another sign that a newsletter is not needed? And the number of articles contributed has tapered off significantly in recent issues.

If FIP is to continue putting out 2 newsletters per year then FIP members are encouraged to suggest topics and authors for future issues.

**This issue.** I thank the authors for the 4 excellent articles included in this issue.

Sultana Nahar has contributed a trip report on her work in India. I learn a great deal from her articles about physics research and teaching in parts of the world quite unknown to me. Nahar’s tireless dedication in communicating in person with physicists in many countries is exemplary. Nahar is certainly working on the front lines and making things happen.

(...) if you feel that something is missing in the area of international scientific cooperation, join the FIP and make it happen! *(from the FIP web page “mission statement”)*

*Ernie Malamud spent three decades at Fermilab participating in high energy physics experiments and accelerator design and construction. He is a Fermilab Scientist Emeritus and is on the adjunct faculty at the University of Nevada, Reno.*



## FIP sponsored or co-sponsored sessions at the APS 2014 Spring Meetings

The APS web pages have links to the abstracts and in many cases the presentations themselves. The links are from the “Epitome” of each meeting, and from there it is easy to find the presentation using the session number and then the specific talk.

Finding the “Epitome” takes a few clicks:

- (1) APS Meetings & Events
- (2) Archives of the Bulletin of the APS
- (3) 2014
- (4) March (or April) Meeting
- (5) Meeting abstracts
- (6) Epitome

### March Meeting 2014

**March 3 - 7 • Colorado Convention Center, Denver, Colorado**



FIP sponsored and co-sponsored invited sessions.

#### **Session B36 Invited Session: Visa and Immigration Policies for 21st Century Science**

Sponsor: FIP. Chair: *Amy Flatten, Director of International Affairs, American Physical Society*

Invited Speakers: *Albert H. Teich, Kathie Bailey, Mathew Gillen*

#### **Session G36 Invited Session: Condensed Matter Physics in China**

Sponsor: FIP. Chair: *Esen Alp, Argonne National Laboratory*

Invited Speakers: *Yupeng Wang, Enge Wang, Changqing Jin, Hong Ding, Lu Yu*

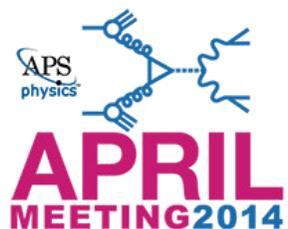
#### **Session W38 Invited Session: 20th Century Chinese Physicists and Physics**

Sponsors: FHP & FIP. Chair: *Danian Hu, City College of New York, CUNY*

Invited Speakers: *Yuelin Zhu, Xiaodong Yin, Tian Yu Cao, Bing Liu, Liu Jinyan*

### April Meeting 2014

**April 5 - 8 • Savannah Convention Center, Savannah, Georgia**



FIP sponsored or co-sponsored invited sessions.

#### **Session J10 Invited Session: Large Scale International Facilities I: Photon Sources**

Sponsors: FIP & DPB. Chair: *Esen Alp, Argonne National Laboratory* Room: 204

Invited Speakers: *Uwe Bergmann, S.L. Molodtsov, Tetsuya Ishikawa*

#### **Session K10 Invited Session: Large Scale International Facilities II: Particle Accelerators**

Sponsors: FIP & DPB. Chair: *Christine Darve, European Spallation Source*

Invited Speakers: *James Yeck, Frederick Bordry, Thomas Glasmacher*

#### **Session E13 Andrei Sakharov Prize Session**

Sponsor: FIP. Chair: *Esen Alp, Argonne National Laboratory*

Invited Speaker: *Boris Altshuler*

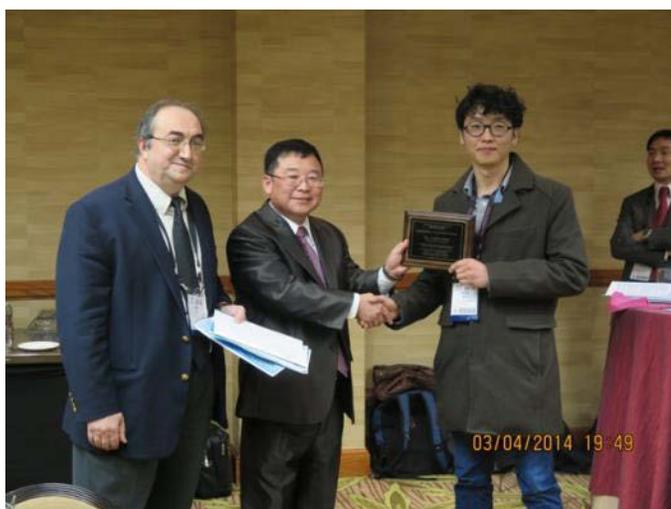
**FIP RECEPTION  
TUESDAY, MARCH 4, 2014  
6:00 - 8:00 PM**

**Governor's Square 12 – Sheraton Denver Downtown**

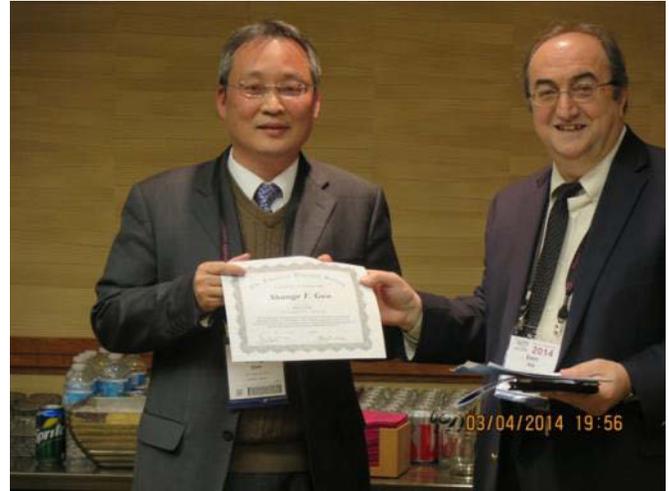
Co-Sponsors:

- APS Office of International Affairs
- Overseas Chinese Physics Association (OCPA)
- Association of Korean Physicists in America (AKPA)
- American Chapter of the Indian Physics Association (ACIPA)
- Iranian-American Physicists Group Network (IrAP)

**Photos by Esen Ercan Alp, FIP Chair**



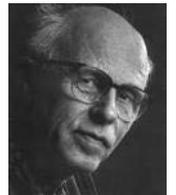
## Photos by Esen Ercan Alp (continued) from the FIP Reception at the Denver APS 2014 meeting



## Photos by Esen Ercan Alp from the Sakharov Prize Session at the Savannah APS 2014 meeting.



**Andrei Dmitrievich Sakharov (Андрей Дмитриевич Сахаров; 1921 – 1989)** Russian nuclear physicist, Soviet dissident and human rights activist.



## Mark your calendars for the Spring 2015 APS Meetings!

Your Program and Executive Committees are hard at work lining up great invited sessions.

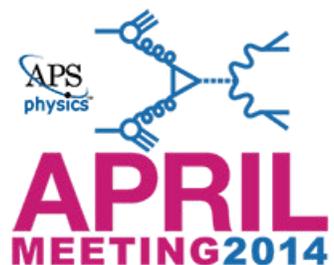
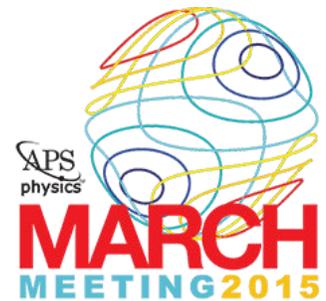
### **March Meeting 2015 • March 2 - 6 • San Antonio Texas**

Join nearly 10,000 physicists, scientists, and students at the Henry B. Gonzalez Convention Center.

### **April Meeting 2015 April 11 - 14 • Baltimore, Maryland**

The APS April Meeting is heading to Baltimore, Maryland!

This meeting will bring together particle physicists, nuclear physicists, and astrophysicists to share new research and insights.



## Participate and vote!!

### ELECTION

*From Noemi Mirkin, FIP Secretary-Treasurer*

The Executive Committee of the Forum on International Physics consists of 13 voting members. The following positions become vacant beginning January 2015: Vice-Chair, (4-year term in the Forum's chair line) and two Members-at-Large (3-year terms). The Nominating Committee, chaired by Sergio Ulloa, did an excellent job selecting the candidates for this election,

The election begins October 15 and ends December 7. All members of FIP will receive official ballot information by email. The notification will include links to brief bios and statements of the candidates and the ballot itself.

The newly elected members will start their terms January 1st, 2015. They will replace the four outgoing members of the FIP Executive Committee whose terms end December 31, 2014: Sergio Ulloa, Luisa Cifarelli and Sultana Nahar.



The American Physical Society  
(APS) and  
The Chinese Physical Society



## **U.S.-China Young Physicists Forum**

*for*

***Graduate Students in Condensed Matter & Materials Physics***

**Saturday, February 28 – Sunday, March 1, 2015  
San Antonio, Texas**

**(To be held the weekend before the APS March Meeting begins.)**

***Additional details regarding registration, abstract submission, and the program will be available at [www.aps.org/international](http://www.aps.org/international). (also see article by Amy Flatten on page 2)***

## The World's Time

*Andrei Derevianko*

As I type this text away, I become aware that time just continues its quiet flow and my keyboard clicks measure its passage. And whatever poetical, philosophical or religious meaning one might assign to the “time”, that is how the time is defined: as a measurable sequence of events.

And time being measurable naturally means that physicists are in business.

Atomic clocks are arguably the most accurate devices ever built. While a typical wristwatch keeps time accurate to about a second over a week, modern atomic clocks aim at neither gaining nor losing a second over the age of the Universe. Imagine that if some poor soul were to build a clock like that at the beginning of time, at the Big Bang, and for some good reason it were to survive through all the cosmic cataclysms, today it would be off by less than a heartbeat.

Atomic clocks are ubiquitous and one could buy a slightly used one on the internet. Among many places,

they tick away on stock exchanges, in data centers, and in the hearts of GPS satellites. However, there is a truly special collection of several hundred atomic clocks distributed among 50 or so industrialized countries that defines the world's time. This timescale is known as the TAI (from the French “Temps Atomique International”) or the international atomic time.

BIPM (Bureau International Des Poids Et Mesures) is at the heart of defining the world's time. This international organization is located in a white wooden two-story building on the forested bank of the Seine River in the Parisian suburbs. Judah Levine from NIST-Boulder explains that BIPM was established in 1875 by the international “Treaty of the Meter” which defined the kilogram and the meter. Later the second was added to the convention (SI units) and the meter redefined in terms of the fixed speed of light and the second. The modern legal definition of the second involves a certain number of beats derived from the hyperfine splitting of cesium-133 atom.

Judah Levine has been contributing US data to TAI for nearly half a century. He explains that BIPM collects

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**Figure 1:** A collection of atomic clocks at the Physikalisch-Technische Bundesanstalt (PTB), Germany. These clocks substantially contribute to the TAI timescale, the world's time. *Credit: PTB*

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clock data from metrology labs and averages them. Then BIPM distributes a document called “the Circular T” which tells by how much the national timescales were off from the average about a month ago. In turn, based on this circular, national labs steer their local timescales to account for the drifts from the TAI. Such a protocol keeps the world’s time stable at the level of a nanosecond over a month.

The most advanced metrology labs rely on the so-called primary frequency standards, super-precise cesium clocks, says Peter Rosenbusch of the Laboratoire Nationale de Metrologie et d’Essais and the Paris Observatory. The primary standars are occasionally used to calibrate other local “workhorse” continuously-run atomic clocks to the SI definition of time as close as possible. In the US, the primary frequency standard is the cesium fountain clock at NIST-Boulder.

So if the world’s time is the time counted by atomic clocks, is it the same as the cosmic time? In principle one could measure time using pulsars, magnetized rotating neutron stars. The pulsars, however tend to slow down over time due to the gravitational wave radiation,

and, moreover, Judah Levine points out that the very shape of the pulses also changes over time making counting the pulses imprecise. We joke that, perhaps, to define the Standard Galactic Time one needs to find more stable cosmic sources.

Nevertheless, space and satellite technology are anticipated to improve TAI. Christophe Salomon of École Normale Supérieure in Paris is involved with the ACES (Atomic Clock Ensemble in Space) mission of the European Space Agency. He explains that the goal is to operate the most precise primary Cs frequency standard onboard the International Space Station (ISS). The clock is expected to become operational in space in two years. ISS would broadcast a microwave time signal down to several Earth-based stations. In the USA, the stations will be installed at JPL in Pasadena and NIST-Boulder. Through the ACES mission, national labs around the globe will establish high precision links to compare primary standards and thus remove some uncertainties in their contributions to the world’s time.

Neither time nor its definition is still. There are new generations of atomic clocks based on ultracold atoms

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**Figure 2: Futuristic quantum clock network.**

**Credit: Jun Ye group and Steve Burrows, JILA**

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and ions that already outperform the primary frequency standards. Pushing these quantum devices to their limits is a friendly competition between several labs around the world. Just over the past year the crown of being the world's most precise clock has been shared by USA (two teams at JILA and NIST-Boulder), Japan, and Germany. These advances have been summarized in recent talks by E. Peik (PTB, Germany) and A. Ludlow (NIST-Boulder, USA) at the International Conference on Atomic Physics held last July in a historic Mayflower hotel in Washington D.C.

Considering this rapid progress in atomic horology, the international community discusses how to redefine the second in terms of these novel classes of clocks. This means retiring Cs from the SI units and redefining the world's time.

Also the clock comparison technology improves. The European Union is building a trans-European clock network using existing optical fiber communication links to compare clocks at metrology labs directly, removing the uncertainties of the over-the-air and over-the-space comparisons. The first 920 km-long link between the northern and southern parts of Germany has been already tested.

One of the apparent limitations of the TAI timescale is that it is a "paper timescale" – it only shows what the world's time was a month ago. What if the dedicated clocks were compared and averaged continuously or even better they formed one single geographically distributed clock? This was envisioned recently by a group of physicists led by Mikhail Lukin at Harvard and Jun Ye at JILA in Colorado. They proposed a quantum network of atomic clocks (for example, placed on satellites orbiting the Earth) that would utilize quantum entanglement to create one giant distributed clock with each nation contributing satellites to the network. Jun Ye comments, "this is definitely a futuristic proposal, and we must achieve substantial technological advances. However, all of the different building blocks for the network have in principle been demonstrated in small scales." May be this is how the world's time would be measured in the far future.

*Dr. Andrei Derevianko is a Russian-American theoretical physicist and a professor at the University of Nevada, Reno. He has contributed to the development of several novel classes of atomic clocks and precision tests of fundamental symmetries with atoms and molecules. Email: andrei@unr.edu*

## Bringing fundamental physics and its applications to Africa

*Christine Darve*

The third biennial African School of Fundamental Physics and its Applications (ASP2014) took place at the UCAD (Université Cheikh Anta Diop de Dakar), Senegal, August 3-23. The 56 students selected and financially supported to attend the ASP2014 three-week course came from 21 African countries in addition to one student from Iran, and another one from the USA. The diversity of countries of origin was enhanced by the diversity of education background, academic levels and 32 % of female students. Students learned about theoretical, experimental and applied physics from leading international scientists. Most of the students are pursuing or have completed advanced degrees in physics, but lack opportunities to gain specialized knowledge in fundamental physics. ASP provides them a professional network.

The aim of the ASP is to build capacity for harvesting and interpreting the results of current and future physics experiments using elementary particles and to increase proficiency in related applications, such as medicine, material science and information technology. The ASP2014 program evolved slightly over the previous ones (ASP2010, Stellenbosch, South Africa and ASP2012, Kwame Nkrumah University, Ghana) by taking into account the feedback from students and lecturers; there is more emphasis now on, for example, digital libraries, the Grid, Geant4 and MC Generators.

The ASP2014 local organizing committee provided a remarkable effort to support the ASP international and advisory committees in organizing this successful event. A broad spectrum of international institutes have

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sponsored this initiative at different levels. The main sponsoring institutes are the International Centre for Theoretical Physics (ICTP), INFN and CERN. In addition, the International Telecommunication Union (ITU) provided 10 scholarships to students from the least developed countries, including 5 female students, and the EU-funded CATHI Marie Curie Initial Training Network supported 9 students. The American contributions originate from APS, IUPAP, NSF, NSRC, JLab, FNAL, BNL, SLAC, Sandia National Laboratory, the University of Chicago, the University of Texas in Arlington as well as Kansas, Rutgers, Louisiana Tech and Oklahoma Universities. ASP2014 financial support also comes from Europe, Africa and Asia thanks to IBS/RISP (Korea), Shui-Chin Lee Foundation for Basic Science (Taiwan) and from the South African government (DST/NRF).

Beyond the academic mission, a "Forum and Outreach" event took place on 16 August, organized with students, lecturers and local policy makers. This year, they were honored to welcome the Secretary-General of the ITU,

Dr. Hamadoun Touré, who gave an inspiring speech highlighting the prime importance of disciplines like mathematics, sciences and especially physics as vectors of development in Africa. The day also served to emphasize the development of the Digital Library thanks to the effort of CERN and UNESCO, as well as briefly mentioning a possible African Light Source to vehicle further scientific cooperation in Africa.

The ASP contributes to broader the training in fundamental physics and its applications in Africa.

· For more information about the school visit [www.africanschoolofphysics.org/](http://www.africanschoolofphysics.org/).

*Christine Darve, a member of the FIP Executive Committee, is an Engineering Scientist in the Accelerator Division of the European Spallation Source (ESS AB P.O. Box 176, SE-221 00 Lund, Sweden). Dr Darve is a member of the International Organization Committee of the biannual African School of Fundamental Physics and its Applications.*



## Astronomy and Astrophysics Progress in India

*Manzoor A. Malik*

Astronomy in India has a glorious past. There are documented evidences that Astronomy was studied in India from the Vedic times dating back to 1500 BC and then nurtured in the fifth and sixth century AD by the greats like Aryabhatta, Varahamihira, Brahmagupta that continued even when Europe was passing through the dark ages. The advent of telescopes shifted the leadership in Astronomy studies from Asia and Middle East to Europe. Even though Maharaja Jai Singh in the beginning of 18<sup>th</sup> century had erected a chain of five observatories in India, it remains a mystery as to why he didn't set up telescopes in those observatories. The beginning of telescope aided astronomy can be ascribed to the commissioning of the Madras observatory by East India Company in 1792. Besides some noteworthy observations, a catalogue of positions of over 11,000 stars was completed using this observatory.

Modern day astronomy in India flourished after it gained independence. An inspiring article by the Nobel laureate C. V. Raman that appeared in the 1943 issue of Current Science might have made an impact. In that article he mentions that Astronomy is the cultural heritage of India and Indians would be unworthy recipients of that heritage if Astronomy as a science is not promoted. As on date, numerous institutes in India are doing frontline research in Astronomy and Astrophysics. The leading ones include: Indian Institute of Astrophysics (IIA), Bangalore; Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune; Aryabhatta Research Institute of Observational Sciences (ARIES), Nainital; Tata Institute of Fundamental Research (TIFR), Mumbai; National Centre for Radio Astrophysics (NCRA-TIFR), Pune; Indian Institute of Science (IISc), Bangalore; Raman Research Institute (RRI), Bangalore; Physical Research Laboratory (PRL), Ahmedabad; Harish-Chandra Research Institute (HRI),

Allahabad. Besides, Institute of Mathematical Sciences (IMSc), Chennai, some of the Indian Institute(s) of Technology (IIT), Indian Institute(s) of Science Education & Research (IISER) and several universities are actively engaged in astronomy and astrophysics research and teaching.

**IIA** hosts a 2-m optical infrared telescope, the world's highest observatory for optical & infra-red astronomy, situated at an altitude of 4500 meters above sea level. The cloudless skies and low atmospheric water vapor make it one of the best sites in the world for optical, infrared, sub-millimeter, and millimeter wavelengths. Another, 2.3 m telescope (VBO) is located in Kavalur, Tamil Nadu. The Kodaikanal Observatory of the Indian Institute of Astrophysics was established in 1899 as a Solar Physics Observatory. The Gauribidanur Observatory, a radio astronomy facility, mainly focuses on the observations of the Sun. IIA is also in the process of establishing a state-of-the-art solar telescope (NLST) which will permit Indian scientists to carry out cutting edge research aimed at understanding the fundamental processes taking place in the Sun. NLST will be the largest solar telescope in the world and would fill the longitude gap between Japan and Europe. The preferred location is Pangong lake site (in Ladakh) owing to excellent "seeing" conditions there. The main research areas pursued at IIA are Sun & Solar System, Stellar & Galactic Astronomy, Extragalactic Astronomy & Cosmology, Space Astronomy, Instrumentation, and Theoretical Astrophysics & Physics.

**IUCAA**, though only a quarter of a century old, is fast emerging as a leading research institute in theoretical astrophysics, cosmology and in observational astronomy. Besides the core academic programs, IUCAA

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has a vibrant visitor academic program aimed to promote the nucleation and growth of active groups in astronomy and astrophysics at Indian universities. Current active areas of research include: Cosmology and large scale structure, Galactic and extragalactic astronomy, Classical and quantum gravity, Cosmic magnetic fields, Gravitational waves, High energy astrophysics, Instrumentation for astronomy, Interstellar medium, Optical astronomy, Radio astronomy, Solar Physics. IUCAA hosts a 2-metre optical and near-infrared telescope and is a key player in some of the major upcoming facilities like TMT, LIGO and ASTROSAT.

**TIFR** has a well-established department of Astronomy where cutting edge research in theoretical and observational astrophysics including instrumentation is carried out. The research interests of the department can be broadly categorized into three groups: X-Ray and Gamma Ray astronomy; Infrared and Optical astronomy; and Theoretical astrophysics. The observations are carried out using ground based facilities as well as balloon-borne and satellite-borne instruments. **NCRA**, the radio astronomy facility set up by TIFR at Pune, has an active research program in many areas of Astronomy and Astrophysics, which includes studies of the Sun, interplanetary scintillations, pulsars, the Interstellar medium, active galaxies and cosmology. NCRA operates the Giant Meter wave Radio Telescope (GMRT), which is the largest Radio Telescope operating at low radio frequencies. It is an open access facility and is used by astronomers across the world. NCRA also operates a large Cylindrical Telescope known as the Ooty Radio Telescope (ORT).

**ARIES** has a unique geographical position ( $79^\circ$  East) that places it at almost in the middle of  $180^\circ$  wide longitude band, between Canary Island ( $20^\circ$  West) and Eastern Australia ( $157^\circ$  East), and therefore complements observations which might not be possible from either of these two places. This has resulted in some unique contributions like optical observations of the afterglow of gamma-ray burst, a few micro-lensing events and quasar variability, new ring systems around Saturn, Uranus, and Neptune were also discovered. The Institute hosts two telescopes of apertures 1 and 1.5 meters and is in the process of setting up of a 3.6 meter optical telescopes at Devasthal, a site known for excellent observing conditions. The research activities of

ARIES in the field of Astronomy and Astrophysics mainly hinge around Asteroseismology, Binary stars, Galactic and extra-galactic astronomy, Instrumentation for astronomy, Polarization, ISM, Dust, Solar system, Star-formation and stellar evolution, Transient objects - Gamma-ray burst, Supernovae and Variable stars.

The first dedicated Indian astronomy satellite, ASTROSAT, is being developed at ISRO (Indian Space Research Organization) and is scheduled to be launched in May 2015. The satellite is designed for the study of cosmic sources simultaneously over a wide range of the electromagnetic spectrum; from optical bands to high energy X-rays. This simultaneous multi-wavelength capability will allow ASTROSAT to make very important contributions in many areas of Astronomy, particularly in the simultaneous multi-wavelength monitoring of intensity variations in a broad range of cosmic sources, the X-ray sky for new transients, sky surveys in the hard X-ray and UV bands, studies of periodic and non-periodic variability of X-ray sources, broadband spectroscopic studies of X-ray binaries, AGN, SNRs, clusters of galaxies and stellar coronae.

While India has a world class observing facility at radio wavelengths (GMRT) and is soon launching the ASTROSAT, with multi-wavelength capabilities in the X-ray and UV domain, similar powerful facilities in the optical and infrared domain are inadequate. Though Indian astronomers have been using some of the existing 5-10 m class international facilities, only three 2 m class optical-IR telescopes exist in India to be supplemented by a 3.6 m telescope to be commissioned soon. Motivated by the limited access to the high end observing facilities and the near impossibility of building a large optical observational facility of its own, India has ventured into the TMT project as a key player. IIA, ARIES and IUCAA are leading the efforts of Indian astronomical community in this venture. India is contributing 10% of the estimated \$1.5 Billion project mainly in kind in the form of preparing key parts of the primary mirror system, developing software, making actuators and sensors that will locate where one mirror is with respect to its neighbors. Being partners (rather than guest observers) in the TMT project with a resolution 12 times better than the Hubble Space Telescope, Indian astronomical community will enjoy a level playing field with leading international astronomers besides

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mastering technology to build large facilities of their own.

Another major involvement is in the Laser Interferometer Gravitational-wave Observatory (LIGO) project. Among the three gravitational-wave detectors presently located in USA, the plan is to move one of these detectors to India where site survey has been already carried out. The strategic importance of the third LIGO detector being set up in India is that it offers the longest baseline possible on earth. A consortium of several institutes in India have come under a single banner called IndIGO (Indian Initiative in Gravitational-wave Observations) to evolve a strategy towards turning the Indian gravitational-wave initiative into reality. The science benefits of this experiment are enormous given the multi-disciplinary nature of the experiment. It will attract and benefit scientists and engineers from fields like optics, lasers, gravitational physics, astronomy and astrophysics, cosmology, computational science, mathematics and various branches of engineering.

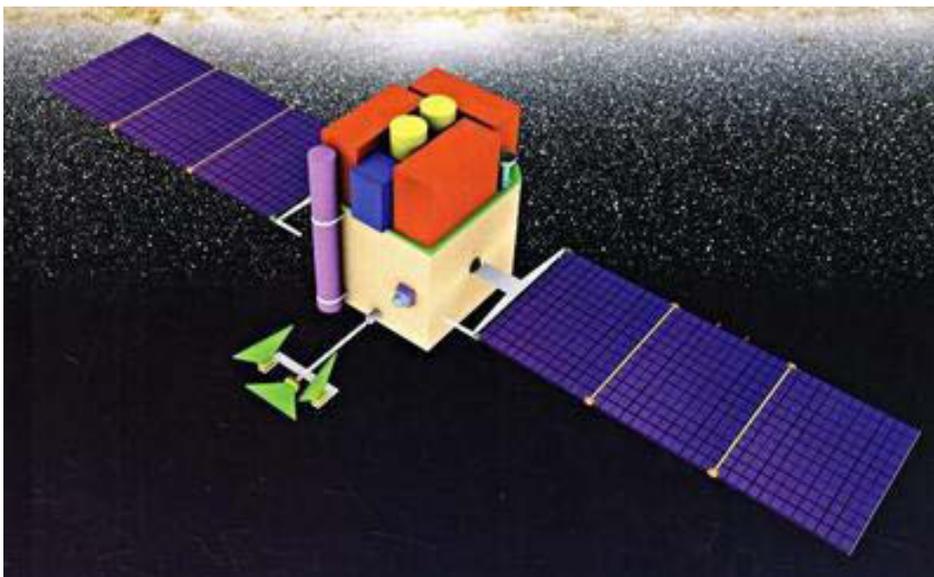
The next major upcoming facility is the India-based neutrino observatory (INO). It is an underground facility to study fundamental issues in science especially neutrino oscillations. INO laboratory's design permits it to also host a dark matter decay experiment. In fact,

DINO (dark matter at INO) experiment is being set up inside the underground INO laboratory.

Further, the success of Chandrayaan-1 mission that found evidence of water molecules on the moon, perfect launch of the Mars orbiter spacecraft making it the first Indian made object to leave the Earth's sphere of influence and other major initiatives like these have opened up a host of opportunities for space exploration using indigenous technology. Space mission Chandrayaan-2 that will orbit the moon and send a small robotic car to the lunar surface, ADITYA-1, a solar observation spacecraft, are also planned. The economics of Indian space missions make them especially attractive e. g. Indian Mars mission cost about one tenth of NASA's Mars mission.

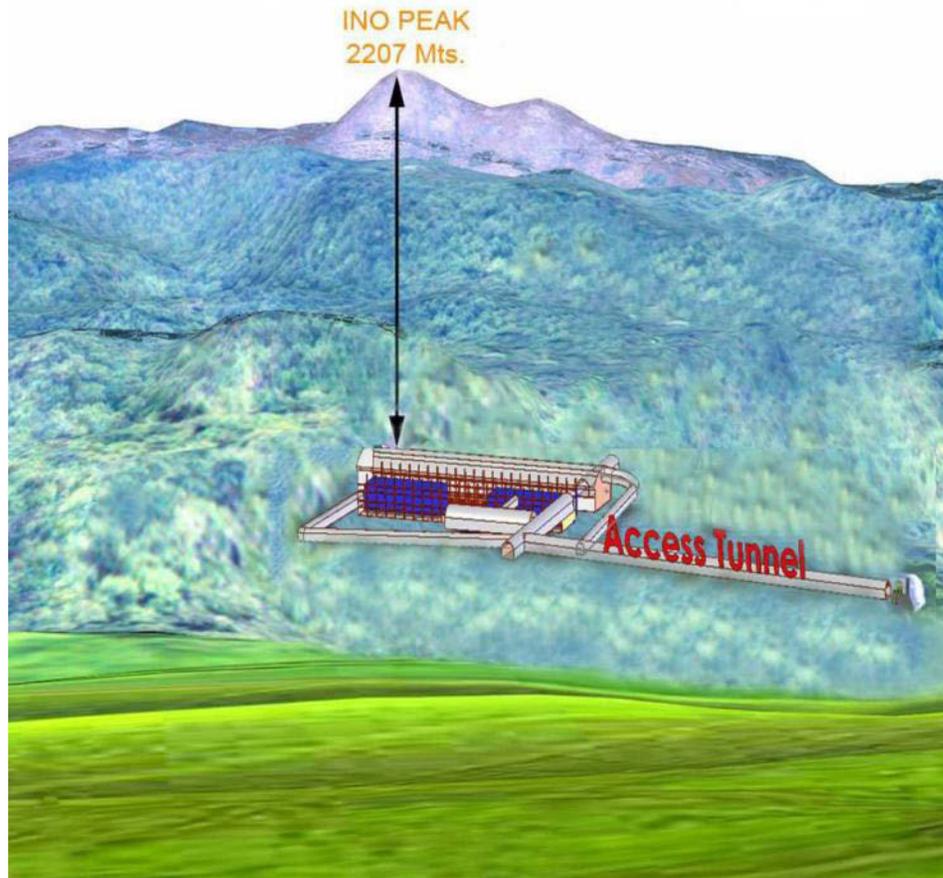
India is marching ahead in Astronomy research aided by ground based, balloon borne and satellite facilities. The future of Astronomy in India is bright and the next decade promises a substantial contribution coming from India.

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**ASTROSAT, shown as it will be deployed, is scheduled to be launched in May 2015.**

## INDIA BASED NEUTRINO OBSERVATORY



INO, The India-based neutrino observatory will study neutrino oscillations and will host a dark matter decay experiment (DINO).



The NLST the world's largest solar telescope will be built in Ladakh.

## India Connection 2

*Sultana Nahar*

*This article is the second part of a report on a 2-month visit to India which began in January 2014. That first part is printed in the spring 2014 issue of this newsletter <http://www.aps.org/units/fip/newsletters/201402/india.cfm>*

### STEM Faculty Training Program

The Obama-Singh initiative is a multi-year program for collaboration and partnership for educational reform, economic growth, and the development of junior faculty funded by the United States-India Educational Foundation (USIEF). Obama-Singh 21st Century Knowledge Initiative awards will be distributed for 5 years, but a recipient of the award will be supported for 3 years. Although there is much excellent work in India, the quality of education is low on an international scale. Young minds desire to learn, but the needed infrastructure for the 150 million students with 300,000 faculty members is missing.

The Ohio State University (OSU) award under the initiative is for faculty training in partnership with Aligarh Muslim University (AMU) in Uttar Pradesh and is called “Training the Next Generation of STEM (science, technology, engineering, mathematics) Faculty at Higher Education Institutions in India in education and research (ER).”

Anil Pradhan, Karen Irving, Adrian Rodgers, and I developed a new dual-degree program. The participants will receive from OSU a Master’s Degree in Education with specialization in STEM ER and a Ph.D. from their home institution in India. Under the program selected students will come to OSU for a year, enroll in classes in the education department, and carry out research in their area of interest in STEM departments. Credit hours in the education and STEM departments will be about equal. The students will continue research and gain field experience in teaching in their home institution in India for another year before receiving the Master’s Degree from OSU. They will also have a research project done under an OSU advisor which can become part of their Ph.D. thesis. Their Indian advisors will collaborate in the project.

OSU is contributing tuition and research facilities to this pilot program. AMU, its Indian partner is contrib-

uting by building the OSU-AMU Center of Excellence with smart classrooms having fast internet connections for distant learning courses. The OSU-AMU Center is housed in the Wildlife Science Center at AMU. The Wildlife Science Center carries out research on animals and is itself a landmark. The first of its kind in India, it was founded in 1986 by AMU Professor Abbas Hussain Musavi after his work in a similar department at the University of Colorado.

In March four AMU Ph.D. students, two men, Asim Rizvi (Biochemistry) and Malik Azeem Anwar (Zoology), and two women, Hala (Physics) and Nida Rehmani (Biochemistry), were selected as STEM ER Fellows.

Pradhan and I shared teaching a course “Radiation physics: Astronomy to Biomedicine” at AMU during February and March. The course covered a number of areas: atomic physics, astrophysics, plasma physics, molecular physics, biophysics, and included a workshop on the use of large codes for atomic structure calculations and collision processes. A total of 128 AMU postgraduate students, researchers and faculty members from Physics, Chemistry, and Engineering enrolled.

We also shared the same course at the University of Delhi (UD) during February and March. At UD 87 postgraduate students, researchers and faculty members signed up and received certificates at the end of the course. Participants at AMU and UD did equally well in the final examination.

Currently in August 2014, the Ph.D. student Fellows of AMU are taking their first class under the program. In June, OSU started the six weeks long distant learning class. Being the first of its kind for international live teaching for both OSU and AMU, each institution had to solve technical difficulties. There were power outages during the monsoon season that would take down the internet. There were also problems with delay in infor-

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mation transmission during questions, answers and comments.

### **Aligarh-Nano 4 International Conference at AMU, March 8-10, 2014**

OSU, through the STEM ER program, was one of the sponsors along with a number of Indian organizations. It was a lively and successful conference with 45 invited talks, about 300 contributed oral presentations and posters from the US, Bangladesh, Egypt, India, Indonesia, Bahrain, Yemen, and Russia. I was a convener of the conference and coordinated in bringing a number of international speakers.

A list of the technical sessions will give the reader a sense for the scope of the conference:

- Nanotechnology for defense and military applications
- Synthesis and characterization techniques of nanomaterials
- Nanotechnology for harnessing energy
- Nanomaterials in food, agriculture and water purification
- Nanoparticles for engineering materials
- Magnetic nanoparticles and applications
- Nanoparticles based drug targeting
- Nanomedicine and health care
- Nanoelectronics, nanosensors and MEMS (Micro-Electro-Mechanical Systems)
- Bionanotechnology
- Nanocosmetics and household products
- Graphene and its nanocomposites
- Organic and inorganic nanocomposites.

The local host, Aligarh Nanomaterials Center of Excellence, is doing well. It added seven more items to the number of newly invented products. Their herbal insecticide gives robust growth to flowers and they have obtained cheap fuel from animal fat.

### **Travel to Educational Institutions and Networking**

Continuation of the OSU-AMU program depends on its success and also the ability to receive grants from Indian granting agencies, and/or support from other

institutions who will enroll their students for the program.

To promote the program our OSU team visited a number of research oriented institutions as well as universities having large undergraduate enrollments and some post-graduate research. We gave seminars on physics applications, held meetings, met relevant people, and made connections with OSU alumni.

The Indian Institute of Astrophysics (IIA) in Bangalore, has the oldest observatory in India. An evening dinner reception at IIA hosted by recently elected APS Fellow Dr. Bhanu Das provided a networking opportunity. We spent a day at the Tata Institute of Fundamental Research (TIFR) located by the Arabian Sea in Mumbai. TIFR has the best research facility in India and also has received the largest research grants in India. Both IIA and TIFR have funds to support students doing research. Tata has now opened a new institute for faculty training.

We visited several private universities: Jain University in Bangalore, and Indraprastha Institute of Information Technology and Thakur's College of Engineering both in Mumbai. These institutions are affiliated with a government accredited university for awarding the degrees. Students who are not admitted to central or state universities often are admitted to a private university, where there is a high tuition. They follow the same syllabus as in the affiliated university, take the same examinations and are granted the degree from the affiliated university. When the institution achieves a required standard and success, it applies for the ability to award independent degrees. These private universities were not very interested in our program since they are doing well already and spending money for faculty training is not necessary.

Indian educators with research objectives appreciate the Obama-Singh program and are hopeful for its success. Dr. Abul Hasan Siddiqi of the AMU-DUTY Society [1] and ISIAM [2] organized a meeting to learn details and explore ways to implement enhancements in STEM education and research. This meeting was held in the Habitat Center in Delhi on January 28, 2014 and attended by professors, Vice Chancellors, researchers, and educators. They came from many institutions: Sharda Ruhilkhand

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and Gautam Budhdha Universities (both in Greater Noida, Uttar Pradesh State), Jamia Millia Islamia University (Delhi), Punjabi University Patiala, Tripura University (Agartala, Tripura State), Guru Gobind Singh Indraprastha University (Delhi), Birla Institute of Technology (Mesra, Ranchi Jharkhand) and Darul Uloom Haqqania Shibli Academy Azamgarh (Uttar Pradesh).

The Odisha Society of Americas [3] is working with the Odisha (formerly known as Orissa) government and us to implement the program in Odisha.

OSU alumni, who returned to India, have been doing quite well. They like to hear positive news of OSU and are pleased to help us promote our program. We met one group in Delhi and another in Mumbai. Some of them have been entrepreneurial in starting companies in computer data analysis transmission, solar cell distribution to villages, children's schools with hands-on education in science, as well as holding high level official positions. OSU has opened up its own office in Mumbai (following the one in Shanghai, China), to keep alumni connected for promotion and networking.

### **International Women's Day (IWD), March 8, 2014**

Aligarh Muslim University traditionally observes International Women's Day. On behalf of the International Society of Muslim Women in Science (ISMWS) I joined Physics Chair Professor Rahimullah Khan in observing the day and took the opportunity to promote and support Muslim women members of AMU to do well in science. Professor Khan invited 60 notable women educators to the program, Professor Zakia Siddiqui, a well known activist for women's education, as the Chief Guest and me as the Guest of Honor. Haris Kunari (Ph.D. physics student) was most helpful in arranging the event. Professor Siddiqui emphasized education and financial independence for women. Event convener Bilqees Banu, biochemistry professor and past chair, spoke of promotions for professional women and that their role as a mother and maintainer of the family needs to be part of the consideration. I presented ISMWS and explained why more women should be in science. Twenty women received recognition at the event.

### **Awards for Best Teaching, Research Publications, and Awards to Students**

Aligarh Muslim University distributed annual Sultana N. Nahar teaching awards in Physics from the trust that I have established and sponsored. Each award consists of a certificate and honorarium of Rs. 18,000 (~\$350). Annual student awards will be distributed later in the year. The two best B.Sc. students, male and female, will each receive Rs. 10,000 (~\$200) and the two best Ph.D. students, male and female, Rs. 15,000 (~\$300) along with certificates.

This year there was close competition among the award winners. Professor Badruddin received the distinguished teacher of the year award. For the best teacher of the year awards, two faculty members, Professors Sabbir Ahmad and Abbas Ali were chosen. The best teacher in the women's college award went to Professor Nasra Neelofar.

The University of Kashmir (U of K) is next to Dal Lake and mountains. Kashmir is a beautiful state, but people in general are poor and heating in their houses is poor. So each person carries a Kangri (a small basket containing burning charcoal) underneath his/her loose warm clothes and they drink lots of tea. During a short visit in March, as at AMU, I promoted physics education, teaching and research. Awards from my trust were given for best research, and best students in B.Sc., M.Sc., and Ph.D. programs in both male and female categories. The Vice Chancellor (VC) Professor Talat Ahmad was most helpful in working out the award program details. The public physics seminar presentation and award ceremony was announced in the Greater Kashmir newspaper. Even with snow covered roads, many people in physics and non-physics as well came for the event. For the 2013-2014 academic year, the winners are Professor Javid Ahmad Shaikh for distinguished teacher, Professor Basharat Want for distinction in teaching, Dr. Gowhar Hossain for the best Ph.D. thesis, Jahoor Ahmad (male) for the best M.Sc. thesis, Nuzhat Nazir (female) for the best M.Sc. thesis, Tahir Rashid (male) for the best B.Sc. student, Iqra Jan (female) for the best B.Sc. student.

Professor Ahmad and I discussed possible participation in the Obama-Singh STEM ER program, a Mem-

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Memorandum of Agreement between OSU and (U of K) and upgrades for the Gulmarh telescope operated by U of K.

At a full house at the women's college I spoke about science and ISMWS. Boards were placed over the snow for people to walk to the event.

Our team from the Ohio State University accomplished many of our objectives during our stay in India. The visit also gave me the opportunity to make progress and complete some of my own educational work in India, separate from the OSU program.



**Professor Jamal Khan of Wildlife Science Department. He is in charge of providing the facilities for the OSU-AMU Center. Wildlife Science Founder Professor Musavi is on the right in the background.**

**Lecture at the Physics Department, University of Delhi.**





Participants at the celebration of International Women's Day.



AMU gave the Indian emblem trophy to both Nahar and Pradhan for contributions to science and STEM ER to Indian institutions under the Obama-Singh initiative.



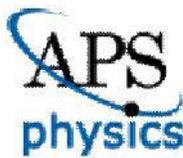
Physics teacher and student award winners (with yellow envelopes) at the University of Kashmir.

### Notes

1. DUTY. The Duty Society (Anjuman-Al-Farz) was founded in 1889 to establish a permanent fund to support poor and needy students.
2. ISIAM. The Indian Society of Industrial and Applied Mathematics.
3. The Orissa Society of the Americas, or OSA, is an organization whose stated goals are to promote the culture of the Indian state of Orissa (on the eastern coast) in the United States and Canada, and to facilitate the exchange of information between Orissa and North America.

*Dr. Sultana N. Nahar is a research scientist in the Department of Astronomy at [Ohio State University](http://Ohio State University) and an elected member of the FIP Executive Committee. She has published extensively on radiative and collisional atomic processes in astrophysical and laboratory plasmas, and also worked on dielectronic satellite lines, theoretical spectroscopy, and computational nanospectroscopy for biomedical applications. Sultana Nahar is the winner of the APS 2013 John Wheatley Award.*

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# Forum on International Physics

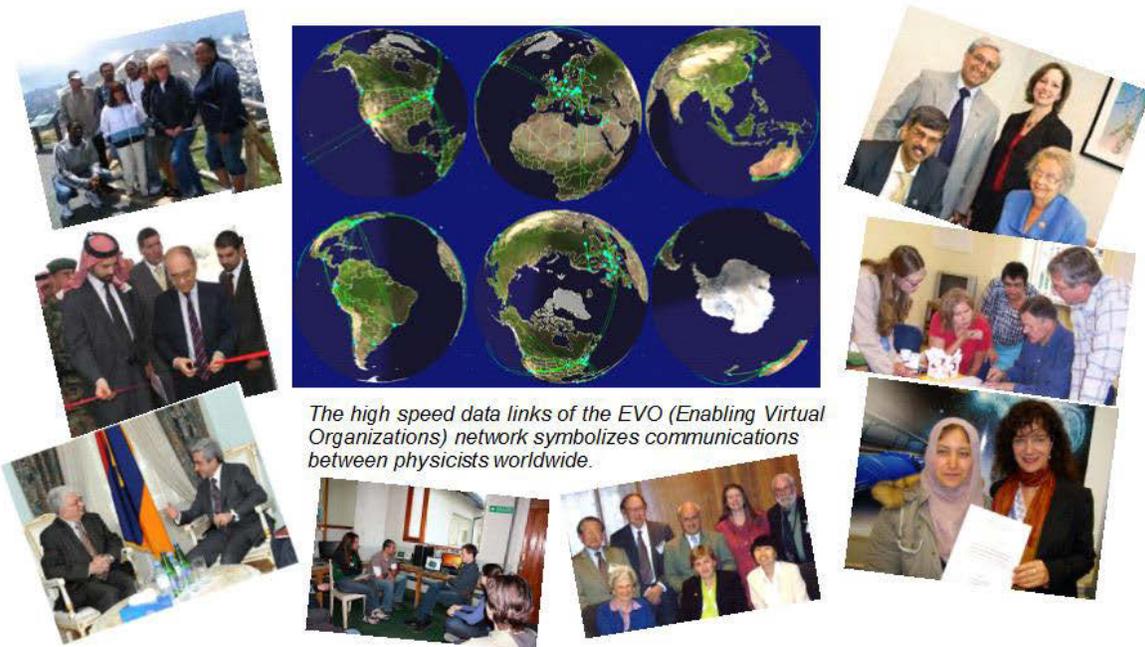
The Forum on International Physics is an association of APS members interested in encouraging cooperative activities between physicists of all countries. FIP supports the development of physics worldwide.

The FIP organizes invited and contributed paper sessions at APS meetings, nominates FIP members to be recognized as APS Fellows, and for the annual John Wheatley Award, communicates with its members via the FIP web site and a periodic Newsletter, and works to affect policies and procedures at the APS deemed favorable to the large number of APS members working abroad.

For more information visit the FIP web site at <http://units.aps.org/units/fip/>

APS members who wish to support the work of the Forum are invited to become members of the FIP. To join go to:

<http://www.aps.org/membership/units/join-unit.cfm>



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