Forum on International Physics

The American Physical Society website: http://www.aps.org/units/fip

Fall 2016 Newsletter

Ernie Malamud, Editor
Maria Longobardi, Associate Editor

Breaking News
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Iran releases physicist
Omid Kokabee

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Breaking News

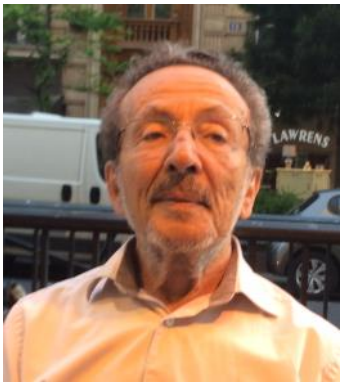
Iran releases physicist Omid Kokabee

After five years in jail, on August 29, Kokabee. now 34 years old, was released on parole. Kokabee is an Iranian experimental laser physicist and was working on his thesis when he was jailed in Tehran in early 2011. Kokabee is corecipient of the 2014 APS Sakharov Prize. Many of you wrote letters or signed petitions at APS meetings to protest Kokabee's incarceration.

More details in Nature.

From the Editor

Ernie Malamud



Introducing Maria Longobardi, our new FIP Editor.

I am very pleased in this issue to introduce our new Editor, Maria Longobardi, who will edit FIP newsletters beginning in 2017.

In the accompanying article by Maria, she establishes her deadline for receipt of materials for her issue as February 1, 2017.

Please be considerate and respect this deadline!

About this issue

This issue will be my 12th (and last) for the FIP (two 3-year terms). Many thanks to the authors for their excellent articles in this issue. I also thank the Newsletter Committee who have also served a 3-year term and have helped by suggesting authors and subjects and also by proofing the final draft.

Throughout my career I have had a passion for participating in international physics activities and also for reaching out to young people at all stages of education. By soliciting specific articles and helping non-English-speaking authors with editing I have been able to fulfill some of these goals. The articles in this issue cover a wide range of international physics activities and events in different countries and several concern reaching out to physicists in developing countries.

Although producing newsletters is time-consuming, I have greatly enjoyed this activity as it has served to keep me in touch with physics and physicists. An added bonus for me has been to work with the outstanding people in the FIP leadership. I can't mention everyone who has been an FIP EC colleague during these 6 years but would like to express my appreciation to Maria Spiropulu, our current FIP Chair, and to Ed Berger, the Past Chair, for the excellent job they each have done. It has been a pleasure to work with them.

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 in Reno. During a meeting in November last year in Grenoble he was elected to the African Light Source (AfLS) Steering Committee. A recent activity has been participation in preparation of the preliminary conceptual design report for the Chinese CEPC-SPPC project.

Message from the Chair

Maria Spiropulu

I am very glad to present highlights of FIP's activities, continuing success and outreach this year. Next year you hear from Cherrill Spencer, our new FIP Chair!

We had productive and well-attended invited sessions at the March and April APS meetings and an effective membership drive. Pictures, news and reports are on the FIP Facebook and twitter feed. I co-organized two important sessions: "Large Scale Neuroscience Projects" (with DBIO) and "Physics and Physicists in Cuba" with APS VP, David Gross. Dr. Fidel Castro Díaz-Balart presented an impressive, and comprehensive report on physics and science in Cuba.

I had a chance to discuss with Dr. Francis Colón (US State Department) opportunities and possibilities for exchange with Cuban scientists given the embargoes. As a follow-up I attended (July) at the Cuban Embassy the 1st anniversary celebration of the diplomatic relations between Cuba and the US, and discussed scientific cooperation prospects with Alfonso Casanova Valdés, the new attaché for science and technology exchanges. I am thrilled to report that my colleague Dr. Ariella Cattai (CERN), who has been fostering research and education exchanges with Cuba for at least a decade, is proceeding with the organization of a detector instrumentation school in Cuba and plans to donate all the modern experimental lab equipment to be used at the school to the Cuban Physical Society. FIP stands ready to help in any way we can and we are looking forward to the success of this important school.

Our FIP Councilor, Young-Kee Kim ran a very dynamic FIP reception during the March meeting, with great participation and interaction with the FIP session speakers, APS officers, members of the co-sponsoring organizations, and fellow FIP members. At the April meeting we witnessed the success of the first round of our Distinguished Student Seminar Program (pilot); Cherrill Spencer and I reported to CISA on the outcome. The next cycle has been launched by Jason Gardner who is working tirelessly on the program.

Ed Berger has chaired the FIP nominating committee and you will soon be called to vote for new members of the Executive Committee! Please take the time to participate and elect your FIP officers and consider getting involved in the future by volunteering or nominating colleagues who wish to serve the FIP mission.

Ed Berger has also chaired the Wheatley Award Committee and we are awaiting the APS council to confirm the recipient of the award as well as the recommended new FIP nominated fellows.

I thank the entire FIP EC for their service in all the committees this year, Cherrill Spencer for Chairing very effectively and swiftly the FIP program committee and especially Ed Berger for his dedication and commitment to FIP and its mission for the past 4 years!

The AAAS Annual Meeting in Washington this year theme was "Global Science Engagement" and I organized a session on "Megascience Global Projects Seeded in Europe, Asia, and the United States" covering the CERN model of international partnership and how it is used as a template for the LBNF/DUNE international project structure in the US, the LIGO model, and the vision for global science projects in China.

I thank the Forum of Industrial Physics for co-sponsoring a reception for the researchers, organizers, directors, advocates, policy makers and funding agency leaders backing global science collaboration and projects that change our perspective of the world and impact our way of thinking and living.

Finally as you will read in this issue, our editor Ernie Malamud will step down and Maria Longobardi become the FIP Newsletter Editor in 2017.

Science is a global enterprise that impacts and advances our human culture and civilization in times of confusing interactions among people and nations. Science can be used as a tool of diplomacy and positive vision for the future. In June the White House published a list of President Obama's Leadership in Science, Technology, and Innovation. The list includes "strengthening international cooperation on science and technology", "Deploying top scientists to advance global diplomacy" and "promoting international connectivity".

Maria Spiropulu, FIP Chair, is an experimental physicist and Professor of Physics at the California Institute of Technology. She is a member of the CMS Large Hadron Collider collaboration.

Editors note: a more complete version of Professor Spiropulu's report, including many links, appears on the APS FIP web page.

Report from the APS International Affairs Office (INTAF)

Amy Flatten

It is a pleasure to convey a few highlights of our international activities that we have undertaken since those described in the spring 2016 FIP newsletter. From past articles and advertisements, I hope you are all aware of, and perhaps availing yourselves of some of the opportunities in our portfolio of ongoing sustainable international programs. These include our travel award programs with Brazil and India, the Marshak & Beller Lectureships, and IRTAP, the International Research Travel Award Program. More information on these is available on our website: www.APS.org/programs/international. I would like to use this article, however, to highlight a few "special events" since this past spring. These represent just a few of our efforts to strengthen our connections and serve physicists around the globe.

Lebanon

This past spring, APS launched its first call for proposals for a professorship/lectureship program for physicists in Lebanon and the United States. The Académie des Sciences du Liban (ASL) and the American Physical Society (APS) signed a Memorandum of Understanding to support scientists wishing to visit the United States or Lebanon.

The professorships/lectureships consist of a short course or a lecture series (three or more lectures) delivered at Lebanese or U.S. institutions. The applications required a joint proposal from the visiting professor and the host professor for the short course or lecture series. Those proposals with research activities that complemented the lectures were given higher priority. I am pleased to announce the following initial recipients of this award:

Dr. Maher A. Dayeh, Space Science & Engineering Division, Southwest Research Institute; San Antonio, Texas, United States. Dr. Dayeh will conduct a series of five lectures on magnetic reconnection at the American University of Beirut (AUB) in October 2016.

Dr. Jihad R. Touma, Department of Physics, American University of Beirut; Beirut, Lebanon. Dr. Touma will give a series of 3 to 4 lectures over two weeks at the California Institute of Technology entitled "From Multiplanets in Binaries to Stellar Black Hole Nuclei: A Leisurely Overview of Secular Dynamics in Near-Keplerian Systems."

The APS has been strengthening its links to the physics community in the Middle East. We hope that this program will be very helpful in establishing closer relations and building networks in Lebanon, as well as serving to build scientific capacity in the region. We wish to congratulate the award recipients and wish them great success.

Cuba

Last March, Laura Greene (APS President-Elect) and I traveled to Havana to meet with the Direction Board of the Sociedad Cubana de Física (SCF), following an invitation by María Sánchez-Colina, President of the SCF.

The meeting took place at the Colegio Universitario San Gerónimo de La Habana and explored needs and interests of the Cuban Physical Society for a partnership with APS. The Cuban physicists identified 3 main goals of SCF-APS cooperation:

- Connecting young Cuban physicists with their U.S. counterparts
- Inviting senior US physicists to teach courses in Cuban universities
- Finding ways to collect equipment donations and send them to Cuban physics institutions

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A meeting between leaders of the Cuban Physical Society (SCF) and the American Physical Society (APS). From left to right: Ernesto Altshuler (Editor of the Revista Cubana de Física), Laura Greene (President-elect, APS), María Sánchez-Colina (President, SCF), Amy Flatten (Director of International Affairs, APS), Juan G. Darias (Vice-president for organizational affairs, SCF), Luis Méndez-Pérez (Vice-president, SCF), Alejandro Cabo (Vice-president, SCF) and Aurora Pérez (Vice-president for financial affairs, SCF). Picture taken on March 8, 2016, at the Colegio Universitario San Gerónimo de La Habana (Picture: courtesy of San Gerónimo's staff)

Photo credit: Cuban Physical Society

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The APS has concrete plans for addressing each of these goals in the upcoming year. In 2017, APS will host a meeting of North American and Cuban physics graduate students in Washington, D.C. It also has established programs for sending senior physicists to Brazil and India, and hopes to use that as a model for future Cuban programs. The Society is also working with other scientific organizations toward collecting equipment donations and finding possible ways to transport them to Cuba—a complicated endeavor, given possible U.S. restrictions or regulations, despite renewed U.S.-Cuban diplomatic relations.

China

At the 2016 March Meeting, the APS leaders held fruitful discussions with the Chinese Physical Society (CPS) and leaders from Chinese universities. These "CPS-APS Leaders Breakfast" meetings began in 2012, and given the positive response from the Chinese participants, they have continued annually. The meetings provide an opportunity to informally discuss editorial concerns and interests, as well as proposals for joint activities. The meeting was hosted by the APS President Homer Neal and included ~ 22 leaders from CPS and APS, including the APS CEO Kate Kirby, the new APS Publisher Matthew Salter, Deputy Secretary-General of the CPS Dongmei-Gu, and physics leaders from Chinese universities and institutes. Following last year's successful U.S.-China Young Physicists Forum, Chinese colleagues suggested several ideas for new joint programs. These included: 1) senior U.S. professors teaching a semester in Chinese universities, 2) sending U.S. undergraduate and graduate students to study in China, and 3) organizing a meeting of leaders of the physics departments from several Chinese and U.S. universities during the March Meeting. APS is following up on these ideas through its Committee on International Scientific Affairs (CISA).

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APS President Homer Neal leads discussions at the CPS-APS Leaders breakfast.

Photo credit: Ken Cole, APS

Physics leaders from Chinese universities and institutes participate in CPS-APS leaders Breakfast

Photo Credit: Ken Cole, APS

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Brazil

In partnership with the Brazilian Physical Society (SBF) and the São Paulo Research Foundation (FAPESP), APS co-sponsored the U.S.-Brazil Young Physicists Forum (YPF) the weekend before the 2016 APS March Meeting in Baltimore, MD.

This event was specifically dedicated to postdocs, as well as early-career physicists in permanent positions, in the United States and Brazil (i.e., any physicists who have obtained their PhD within the past 10 years). The Forum focused on helping attendees build international and interdisciplinary networks and provided participants with networking, scientific presentations, and social events with leading Brazilian and American physicists working in academia and industry.

During the day and a half meeting, eminent senior physicists presented plenary talks to the early-career physicists, followed by parallel sessions with the participants themselves presenting to each other. Two panel discussions focused upon professional development and

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career-building: **"University-Industry Collaboration in Research in the U.S. and Brazil"** and **"Life as a Young Physicist in Brazil and the United States."** Likewise, a lively poster-session/networking-reception allowed early-career physicists to discuss their research with international peers, industry leaders, and distinguished VIPs from the São Paulo Research Foundation, APS and SBF.

Leaders from both physical societies participated, including, APS President Homer Neal 2016 and APS CEO Kate Kirby. APS President-Elect Laura Greene gave a session on "Publishing in Peer-Reviewed Journals." Likewise, both the President and Vice President of the Brazilian Physical Society, Roberto Galvão, and Belita Koiler, gave plenary talks, along with 2014 APS President Malcolm Beasley, and APS Vice-President, Roger Falcone.

Participants in U.S.-Brazil Young Physicists Forum.

Photo Credit: Ken Cole, APS

Throughout the YPF, the young physicists discussed their work with potential partners and international colleagues in a smaller, more intimate setting than the larger 2016 March Meeting would have allowed. We hope that the relationships formed at this conference can last throughout the participants' professional lives, as they continue to attending APS or SBF annual meetings, and other international conferences in related subfields. Hopefully, the U.S.-Brazil Young Physicists Forum leads to many fruitful interdisciplinary and/or international networks and collaborations throughout the participants' careers

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

Maria Longobardi, new FIP Newsletter Editor

Maria ***Longobardi***

As the new "Editor-Elect" of the FIP newsletter, first of all, I would like to thank Ernie Malamud, the newsletter editor for the past six years for his dedication and competence. He has been a reliable source of enthusiasm and passion for me and for all newsletter readers. During these years, the newsletter has become a reference point for the FIP community, establishing an open dialogue with its members and casting light on international scientific communication and cooperation and by fostering dialogue among physicists of all countries. I'm honored to succeed Ernie beginning with the next issue. He will continue to contribute his professionalism to the FIP newsletter as an Associate Editor.

Cooperation is a key for all scientific communities. The APS is one of the largest community of physicists and, due to its high international profile offers a unique opportunity for scientific and cultural interexchange between researchers of different disciplines and countries, with particular attention to young researchers.

I'm also pleased to announce that starting from the next year two special editions of the newsletter will be released for the APS meetings, both for the March and April Meetings 2017, reporting all the FIP activities and the sessions and events of interest for the international physics community at these meetings.

If you want to contribute to the next issue of the spring 2017 newsletter, the deadline for sending me your articles is 1 February 2017.

You can send your contributions in.doc files and ima ges in .tif or .jpg format to marialongobardi@gmail.com

About Maria. (From the Ernie Malamud)

Maria was born in Naples, Italy and did her PhD work at the University of Salerno and the University of California, Berkeley. She worked in experimental condensed matter physics at the University of Geneva on the electronic properties of atomic scale systems.

Currently, she works in the Section of Microbiology of the Department of Botany and Plant Biology, at the University of Geneva. She is working on the development of novel biomaterials integrated with graphene and other materials.

Maria served also in the FGSA as an elected International Student Affair Officer during the last 4 years and as the FGSA Newsletter Editor.

She is an elected member-at-large of the FIP Executive Committee and was elected for a 3-year term as FIP's new Editor at the April 16, 2016 Executive Committee meeting in Salt Lake City.

FIP Activities at the March 2016 Meeting

Session B12 FIP DBIO: *Large Scale Neuroscience Projects*
Chair: Maria Spiropulu, California Institute of Technology
Invited Speakers: Terry Sejnowski, Miyoung Chun, Hanchuan Peng, David Tank

Session P14 FIP DCOMP: *International Cooperative Efforts for Electronic Structure Methods*
Chair: Aldo Romero, West Virginia University
Invited Speakers: Lucia Reining, Gian-Marco Rignanese, Francois Gygi, Micael Oliveira, Andrea Marini

Session Y4 FIP: *Physics and Physicists in Cuba*
Chair: Maria Spiropulu, California Institute of Technology
Invited Speakers: David Gross, Fidel Castro Diaz-Balart, Frances Colón

The FIP annual reception took place on Tuesday evening, March 15 at the Baltimore Hilton. The reception, co-sponsored by the APS Office of International Affairs (INTAF), the Overseas Chinese Physics Association (OCPA), Association of Korean Physicists in America (AKPA), and the Iranian-American Physicists Group Network (IrAP), was a great success. Dr. Amy Flatten (INTAF Director) spoke about the mission and activities of the APS FIP. Following Flatten's talk the other international organizations made presentations and gave awards.

FIP Activities at the April 2016 Meeting

Session S7 FIP DPF: *Big International Neutrino Projects and Collaborations*
Chair: Maria Spiropulu, California Institute of Technology
Invited Speakers: David Wark, Mark Thomson, Marco Zito

Session U7 FIP *Sakharov Prize Session*
Chair: Maria Spiropulu, California Institute of Technology
Invited Speakers: Zafra Lerman, Perry Link, Adam Jermyn

Session X7 FIP *Physics and Physicists Around the World*
Chair: Maria Spiropulu, California Institute of Technology
Invited Speakers: Vladimir Shiltsev, Hossein Sadeghpour, Wang Yifang

Session Y7 FIP *Next Generation of Large International Telescopes and Cosmic Experiments*
Chair: Maria Spiropulu, California Institute of Technology
Invited Speakers: Fred Raab, Angela Olinto, Miguel Morales

Physics diplomacy, careers and research in 15 different countries feature in FIP's invited sessions at the 2017 APS meetings

Cherrill Spencer

From Argentina to Taiwan, with stops in 13 other countries, from the Early Bronze Age to the future, with stops in tenth century Arabia and medieval Italy along the way, with an Indian entrepreneur, a Russian diplomat, a US economist and yes, quite a few physicist speakers, the seven invited sessions that FIP has organized for the 2017 March and April APS meetings will be interesting, informative and worth your while to attend.

Taking advantage of the so-called April meeting being held in Washington DC in January we will posit that "Physics Improves International Diplomacy", with the help of a high-ranking Russian diplomat, a science advisor to the US Secretary of State and the Executive Director of International Affairs at the US National Academies. We will also highlight that "Physics Drives Our Economy" with a talk by an economist who has studied the economic effects of hundreds of thousands of foreign STEM students living and studying in the USA and has bust some myths about H1B visas. He will be joined by an Indian physics professor and entrepreneur who will encourage young physicists to take their talents into the commercial world and create new products. "The Roles of Physicists in International and Not-For-Profit Organizations" is a session focused on informing young physicists (and their professors) about careers outside academia. The speakers will be from the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Atomic Energy Agency (IAEA) and a fellowship program at the National Academies. FIP is co-sponsoring this session with the Forum on Physics and Society.

Our fourth invited session at the "April" meeting (happening from Saturday 28th to Tuesday 31st January 2017) will take us deep underground on three continents as physicists tell us about the facilities and experiments being done at the ANDES deep underground laboratory in a tunnel between Argentina and Chile, the underground laboratory in South Korea and the South Africa Underground Physics laboratory.

Did you know that cosmic ray muons have been used to "see" into the thick walls of Florence's Il Duomo, looking for structural defects? You can find out about Muon Tomography in our invited session "Physics Tools for Cultural Heritage Investigations" at the March APS meeting. This session will have five speakers who will describe a wide range of physics techniques being used to investigate very ancient and just several centuries old artifacts, to understand if they are deteriorating and develop ways to preserve them if necessary. At our second invited session at the March meeting (13th -17th March 2017, New Orleans, Louisiana) you will find out how accelerator-produced muons are being used to investigate high temperature superconductors, thin films, semiconductors, low temperature magnetism and novel energy materials. Our five invited speakers come from Canada, Israel, Japan, Portugal and Switzerland. They carry out their experiments at ISIS (UK), PSI (Switzerland), RIKEN (Japan) and TRIUMF (Canada).

Our third invited session at the March meeting will introduce four new X-ray light sources to the condensed matter -, bio- and chemical- physicists who attend the March meeting, so that they can evaluate if they could use the X-rays produced by these new machines in their research. The first of the five speakers will give an introduction to the fundamentals of synchrotrons and Free Electron Lasers (FEL) and their resulting radiation characteristics. The other four speakers, all Directors of their institutes, will describe their recently commissioned facilities and how to apply for beam time at: MAXIV (Sweden), Pohang FEL (South Korea), SESAME (Jordan) and the Taiwanese Photon Source (Taiwan). The Division of the Physics of Beams is the unofficial co-sponsor of this session.

As I write this summary the dates and times of these 2017 FIP invited sessions have not yet been set. We

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will send FIP members an email detailing speaker names, talk titles, session numbers, dates and times when they have been set and I hope you will plan to attend them; they will enhance your knowledge of physics activities and physics careers all around the world.

The Forum on International Physics Program Committee helped me develop the 7 topics covered in our invited sessions and find the 27 invited speakers who will fly in from all corners of the globe to tell us about their work and I thank the committee for their efforts.

Cherrill Spencer, retired from the SLAC National Accelerator Laboratory, is a Magnet Physicist/ Engineer, and is our FIP Chair Elect. As FIP Chair Elect Spencer chaired the FIP Program Committee and was responsible for organizing the FIP sponsored sessions at the spring 2017 APS meetings. In 2017 Spencer becomes FIP Chair.

March Meeting 2017 • March 13-17 • New Orleans, LA

John Wheatley Award

Edmond L Berger

The American Physical Society's John Wheatley Award was created in 1991 with support from the FIP. It was established to recognize the dedication of physicists who have made contributions to the development of physics in countries of the third world. This award is bestowed every two years, every odd-numbered year, at a general meeting of the APS.

Nominations for 2017 Wheatley award were due by July 1, 2016. FIP established a committee to examine these nominations, consisting of Per Nordblad (2015 Wheatley winner), FIP Vice Chair Jerry Peterson, former FIP Members-at-Large Christine Darve and Alex de Lozanne, with FIP Past Chair Edmond Berger serving as Chair of the selection committee. Berger has submitted the selection committee's recommendation, but it must be approved by the APS Council of Representatives before it is official and can be made public.

Eight nominations of distinguished scientists were received before the July 1 deadline. Nominations remain active for 3 review cycles so those not selected for the award in one year are automatically reconsidered again. Nevertheless, it is highly recommended that nominations be updated, especially in cases, as happened this year, in which candidates change institutions and accept new responsibilities.

It is not too soon to begin thinking of new nominations of distinguished scientists whose career includes compelling evidence of collaboration on physics research and/or of teaching physics in countries of the third world. Nominators should consider carefully the guiding criteria for a Wheatley award:

- an outstanding contribution to the development of physics in a country or countries of the third world through work with local physicists in physics research or teaching;
- the award will not be given to a person for work in his or her own country.

And, by all means, be proactive in nominating deserving women physicists and members of underrepresented groups. Please see the APS Prize & Award Nomination Guidelines at **http://www.aps.org/programs/honors/nomination.cfm**.

Edmond L Berger is the Past-Chair of the FIP

John C. Wheatley (1927 – 1986)

Wheatley was one of the preeminent physicists of his generation, best known for fundamental and original measurements that led to great advances in the understanding of quantum fluids and solids. His fame stems from his research on liquid helium-3.

During his illustrious career he received many awards, was elected to the National Academy of Sciences.

In the 1960s he worked at the then newly created Instituto de Física (now the Balseiro Institute) of the Centro Atómico Bariloche in San Carlos de Bariloche, Argentina, which in a national park in Patagonia. He led the building of the Bariloche lab, but he taught people what it took to be competitive worldwide at a time when there was little experimental physics in South America

By the time he left, liquid air, hydrogen, and helium had been produced, adiabatic demagnetization refrigeration had been accomplished, and research projects were under way, including a measurement of the heat capacity of pure He down to millikelvin temperatures. Under the subsequent leadership of students that John helped train, the laboratory became one of the premier experimental research centers in South America. John's efforts on behalf of the Bariloche laboratory were recognized by the APSs establishment of the biennial John Wheatley Award "to honor and recognize the dedication of physicists who have made contributions to the development of physics in countries of the third world."

From Wikipedia and a National Academy of Sciences biographical memoire

Fourth African School of Fundamental Physics and its Applications in Rwanda

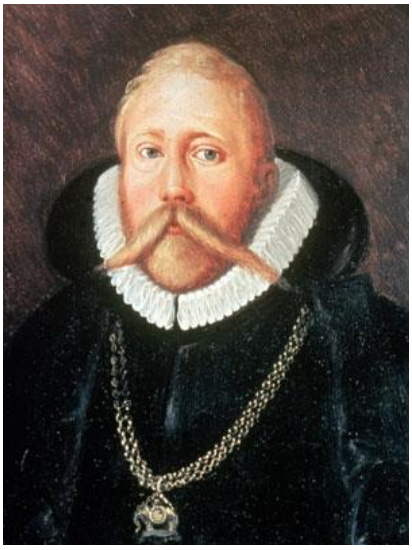
Submitted by Christine Darve (European Spallation Source, Sweden) on behalf of he ASP2016 International Organizing Committee

The fourth biennial African School of Fundamental Physics and Applications (ASP) has taken place at the University of Rwanda's College of Sciences and Technology from August 1-31, 2016. The ASP2016 brought together 56 students from 28 African countries, one from the US and 20 from Rwanda, most of the students being in masters and PhD programs. Leading scientists from all over the world lectured during the 3-week long summer school. The objective of the school (a non-profit organization) is to increase capacity development in fundamental physics and related applications in Africa. The ASP program is funded by 20 research institutes, international organizations, government agencies and universities, including ESS, CERN and ICTP.

Second Nordic Particle Accelerator School at Lund University

Submitted by Christine Darve (European Spallation Source, Sweden)

The second Nordic Particle Accelerator School, NPAS2016, took place at Lund University, August 15-23, 2016. The event was sponsored by the European Union Strategic Partnership's grant, NPAP (Nordic Particle Accelerator Program). The NPAP aims to broaden the opportunities for education in accelerator physics and technology, in particular for students from the northern part of Europe, by developing summer schools and a MOOC (massive open online course). The objective of the program is to ensure future European accelerator expertise that can exploit, develop and improve current and future particle accelerators. The NPAS and the MOOC are organized by the MAX IV Laboratory, European Spallation Source (ESS), and the Universities of Lund, Uppsala, Aarhus, Oslo and Jyväskylä, together with a partnership of several additional European universities. The photograph was taken during an excursion to Stjerneborg (Star Castle), Tycho Brahe's underground observatory next to his palace-observatory Uraniborg, located on the island of Hven in Øresund.



Tycho Brahe (1546—1601)

The International Union of Pure and Applied Physics

Kennedy Reed

The International Union of Pure and Applied Physics (IUPAP) traces its beginnings to Brussels in 1922. IUPAP was established that year with thirteen countries as founding members. Today there are sixty members. These members are communities of physicists in countries or regions around the world. The mission of IUPAP is to assist in the worldwide development of physics; to foster international cooperation in physics; and to help in the application of physics toward solving problems of concern to humanity.

IUPAP is governed by its **General Assembly**, which meets every three years and brings together delegates from all of the member countries or regions. The General Assembly elects an **Executive Council**, which oversees and administers IUPAP's activities between the General Assembly meetings.

IUPAP currently has nineteen specialized international **commissions**. Seventeen of these cover particular subfields of physics (eg.Nuclear Physics, Atomic, Molecular and Optical Physics, Plasma Physics, Astrophysics,…etc.) These commissions promote international cooperation in their particular subfields. Every year IUPAP sponsors 20 to 30 **international conferences**, and each of the specialized commissions recommends international conferences in its particular subfield for IUPAP sponsorship or endorsement. The commissions also grant awards or prizes to recognize physicists who make outstanding contributions to the particular subfields of physics covered by the commission. Of particular importance are the **Young Scientists Prizes** that commissions grant to recognize and encourage early career scientists who have carried out especially noteworthy research in their subfield during a period within eight years of completing their Ph.D. The recipients of these Young Scientists Prizes are prominently featured on the IUPAP website and in the IUPAP newsletters.

The Commission on Physics for Development works to help improve conditions for physics and physicists in developing regions of the world. This commission proposes and supports initiatives that contribute to development, and makes recommendations regarding IUPAP support for international conferences and workshops in developing countries. The African School Series on Electronic Structure Methods and Applications (ASESMA) is a noteworthy example of this commission's work. ASESMA was initiated as a joint effort of the Commission on Physics for Development and the Commission on Computational Physics, and in partnership with the International Center for Theoretical Physics (ICTP) in Trieste, Italy. This series of schools on computational materials science is planned on a biennial basis, and focuses on theory and computational methods for predicting and understanding materials through calculations at the fundamental level of electronic structure. Particular emphasis is placed on appli-

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Lecture in 2016 ASESMA at University of Ghana. June 2016

Banner for ASESMA 2016 in Ghana

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cations relevant to developing countries in Africa. The fourth school in this series took place June 12 -22, 2016 at the University of Ghana. Previous schools were in Cape Town, South Africa (2010), Eldoret, Kenya (2012), and Johannesburg (2015).

The efforts of this commission also recently led to the establishment of the **IUPAP Medal for Outstanding Contributions to the Enhancement of Physics in Developing Countries**, It is expected that the first of these medals will be awarded at the next General Assembly.

The **Commission on Physics Education** works on collection, evaluation and distribution of information on education in the physical sciences among members of the international scientific community. This commission helps physics teachers in all countries and at all levels to incorporate current knowledge of physics, physics pedagogy, and the results of research in physics education in their courses and curricula.

There are also **Affiliated Commissions**, which are groups of scientists recognized by the General Assembly, but appointed by other scientific bodies. The four current affiliated commissions are: AC1-International Commissions for Optics (ICO); AC2-International Commission on General Relativity and Gravitation; AC3-International Commission for Acoustics; and AC4 -International Commissions on Medical Physics

The work of IUPAP is also carried out in **Working Groups**, which focus on topics that need international and interdisciplinary cooperation and can potentially lead to the development of new fields of research. Working groups are generally of limited duration, and new working groups are appointed as warranted by emerging needs in the scientific community. Working groups sometimes can lead to the formation of new IUPAP commissions. In March of 2016, IUPAP announced the formation of a new **Working Group on Accelerator Science**.

While the specialized international commissions cover a broad range of subfields of physics, IUPAP also maintains close liaison with several other international scientific bodies to cover interdisciplinary activities. In particular, IUPAP is a member of the **International Council for Science** (**ICSU**), and appoints representatives to ICSU and some of ICSU's other members and committees. Examples of such committees are the Committee on Data for Science and Technology (CODATA), the Committee on Space Research (COSPAR), the Scientific Committee on problems of the Environment (SCOPE), and the Consultative Committee on Units (CCU).

IUPAP has a role in the verification and naming of **new elements**. IUPAP and the International Union of Pure and Applied Chemistry (IUPAC), set up the **IUPAC/IUPAP Joint Working Party on Discovery of Elements** to review and validate claims of the discovery of new elements. In January of 2016 the Joint Working Party published a report verifying the discovery elements 113, 115, 117 and 118. These four newly discovered/produced elements complete the seventh row of the periodic table. In June of 2016 the provisional names for these new elements were announced in simultaneous press releases by IUPAC and IUPAP.

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In addition to the scientific work in the specialized international commissions, affiliated commissions and working groups, IUPAP is concerned with matters of **Policy**. IUPAP actively upholds the principles of the **Universality of Science** and the **Free Circulation of Scientists**. Consequently, IUPAP only sponsors or endorses conferences when the requesting conference organizers document that these principles will be upheld. When situations develop that run counter to these principles, IUPAP registers its concern regarding these situations. Accordingly, when sanctions and travel restrictions were imposed on Turkish scientists after the recent unsuccessful coup, IUPAP issued a statement expressing concern that these actions are contrary to the principle of free circulation of scientists, and encouraging the authorities to remove the restrictions. The full text of this statement is on the IUPAP website.

IUPAP strongly encourages increasing the number and status of women in physics, and insists that women are represented as organizers, speakers and attendees of IUPAP sponsored conferences. **The Working Group on Women in Physics** is charged with surveying the situation for women in physics in IUPAP member countries, and analyzing and reporting the data along with suggestions on how to improve the situation. Starting in 2002, an **IUPAP International Conference on Women in Physics (ICWIP) has been convened every three years.** These conferences bring delegates from around the world to showcase scientific work in all areas of physics, and to address gender issues in science and promote the participation of women in physics. These conferences have been held in France, Brazil, Korea and South Africa. The 2014 conference took place in Waterloo, Canada; plans are underway for the 2017 conference in Birmingham, UK.

In 2011, the position of **Gender Champion** was proposed to strengthen connections between the IUPAP commissions and the Working Group on Women in Physics. Since that time, every three years a Vice President at Large from the Executive Council has been appointed to serve in that position. The Gender Champion collects information on the representation of women in activities of IUPAP commissions, and assists in tracking the representation of women in all IUPAP activities.

In addition to the concerns regarding the representation of women in IUPAP activities, efforts are made to ensure reasonable balance of geographical representation on IUPAP commissions and in IUPAP activities.

In December of 2014 the IUPAP Administrative Office moved from London to its present location in Singapore. This is the first time the IUPAP office has been located in Asia, and to some extent reflects the growing importance of physics in member countries in this region. Similarly, the selection of São Paulo, Brazil as the location of the next General Assembly reflects the growing importance of physics in member countries in another region. This will be the first IUPAP General Assembly in South America.

Kennedy Reed is a theoretical physicist in the Physics Division at Lawrence Livermore National Laboratory, and is also the President Designate of IUPAP

IUPAP Council and Commission Chairs meeting in Trieste, Italy. April, 2015.

The Contribution of the IUCr to the Development of Scientific Education, Research and Infrastructure in Africa

Michele Zema

The International Union of Crystallography (IUCr, http://www.iucr.org) is a scientific union adhering to the International Council for Science (ICSU). Its objectives are to promote international cooperation in crystallography and to contribute to all aspects of crystallography, to promote international publication of crystallographic research, to facilitate standardization of methods, units, nomenclature and symbols, and to form a focus for the relations of crystallography to other sciences. The IUCr fulfils these objectives by publishing primary scientific journals (see http://journals.iucr.org), the series of reference volumes *International Tables for Crystallography*, distributing the quarterly *IUCr Newsletter*, maintaining the online World Directory of Crystallographers, awarding the Ewald Prize and organising the triennial Congress and General Assembly. In addition, the IUCr supports numerous crystallographic activities and events through its sponsorship schemes, and carries out a wide programme of outreach activities aimed at improving public awareness of the field, allowing access to instrumentation and high-level research, nurturing "home-grown" crystallographers in developing nations, and increasing international collaborations for the benefit of future generations.

An important boost to the IUCr educational and outreach programme was given by the International Year of Crystallography 2014 (IYCr2014). The IUCr and UNESCO received a strong mandate from the UN to coordinate the activities of the International Year. In their resolution, the United Nations General Assembly recognized that "*humankind's understanding of the material nature of our world is grounded, in particular, in our knowledge of crystallography*", and stressed that "*education about and the application of crystallography are critical in addressing fundamental challenges*". At a time when scientific endeavour is critical for societal benefit and despite the immensely powerful scientific influence of crystallography over the past century, this discipline is rarely a priority of governments and is scarcely known by the public. Understanding the structure of matter and relating this to the properties and functionality of any kind of compound has provided new paths for scientific research, has transformed industries and created new frontiers, from the design of new medicines and materials to assessing the mineral content of Mars. The future global economy will be determined by progress in cutting-edge fields. However, the playing field is not level in crystallography, and fundamental courses on crystallography are disappearing from most academic degree curricula and are almost absent in the developing countries.

Consequently, several activities are conducted by the IUCr to promote crystallography and science in general in the developing regions. Among these, the IUCr ***Crystallography in Africa*** initiative was launched in 1999, following an idea of J.C.A. Boeyens. The initiative is presently coordinated by C. Lecomte (U. Lorraine, Nancy, France). The programme not only trains teaching staff and PhD students in crystallography but also provides participating universities with instrumentation (thanks to the partnership with some private companies) in order to enable them to conduct independent research. Many countries have been targeted, including South Africa, Morocco, Tunisia, Algeria, Cameroon, Senegal, Cote d'Ivoire, and others, such as Gabon, Kenya, Zambia, Madagascar, Burkina Faso and Benin are in the pipeline. In 2012, a diffractometer was installed at the University of Dschang, Cameroon, and the faculty staff and students were trained. In October 2016, the same University will host the **1st Panafrican Conference on Crystallography** (http://pccr1-2016.univ-dschang.org/), a major achievement for the development of a scientific community in the region. As part of the activities for IYCr2014, a Summit meeting was organized in Bloemfontein (South Africa), which offered an opportunity for African crystallographers, scientists, science administrators, policy-makers and industry leaders to discuss the challenges that this science is facing in the African continent. This led to the IUCr-ICSU "***Building Science Capacity in Africa via Crystallography***" initiative, funded by an ICSU grant in 2015, which is addressing some of the issues highlighted at that meeting. More recently, the IUCr

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has enthusiastically accepted the invitation from IUPAP to take part in the programme and activities for the African Light Source. Such a project, although still very preliminary, is already contributing to the formation of a community of African scientists, as demonstrated by the very successful launch meeting held in Grenoble in November 2015.

The African scientific community is also one of the targets of the ***IUCr-UNESCO OpenLab*** initiative, a network of operational crystallographic laboratories, organized in partnership with industry, which is enabling students in far-flung lands to have hands-on training in modern techniques and exposure to cutting-edge research in the field. The aim of the OpenLabs is to make science more broad-based and energize youth in parts of the world that have remained underdeveloped for too long.

Similar programmes are being developed by the IUCr in other regions, like South-East Asia and Latin America. The IUCr is willing to collaborate and share efforts with any other scientific society or educational institution to develop a programme aimed at reducing the science capacity gap between the wealthiest and the poorest regions of the world by increasing the linkage between science policy and the regional scientific communities, and by fostering international scientific cooperation. A dedicated **IUCr Outreach and Education Fund** (http://www.iycr2014.org/legacy/iucr-outreach-fund) has been established for this purpose and individuals, institutions and companies are invited to donate to help achieve these aims.

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Installing the diffractometer at the University of Dschang, Cameroon

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Signing the final declaration at the IYCr2014 Pan African and South African Summit meeting (Bloemfontein, October 2014). Seated at table (from left): Patricia W. Gitari (Kenya), Habib Boughzala (Tunisia), Abdelmalek Thalal (Morocco), Zephirin Yav (DR Congo). Standing: Michele Zema (IUCr; Italy), Jean Paul Ngome-Abiaga (UNESCO; Gabon), Santiago García-Granda (IUCr; Spain), Andreas Roodt (South Africa; organizer of the Summit meeting)

Dr Michele Zema is a researcher and lecturer in Mineralogy and Crystallography at the University of Pavia, Italy and Outreach Officer at the International Union of Crystallography. He has served as Project Manager for the UN International Year of Crystallography 2014. His research activity deals mainly with the structural behaviour of solid solutions of inorganic materials at different conditions of temperature and pressure. Michele Zema is actively engaged in a number of educational and outreach programmes, from primary school to postdoc levels, which are also aimed at nurturing scientific activities

OSU Stem Faculty Training Project Achieves Milestone

Sultana N. Nahar

The new STEM (Science, Technology, Engineering, Mathematics) Faculty training project of the Ohio State University (OSU) achieved a milestone with the graduation of the first group of Indian students from Aligarh Muslim University (AMU) in May 2016. To administer the final exams and research presentations of the students, the OSU team traveled to AMU in March 2016. The M.Ed is a new dual degree in the STEM program for Ph.D. students in STEM disciplines. They study in Indian institutions to learn world-class skills for teaching undergraduates and how to lead advanced research. This STEM ER (Education and Research) program, under the Education Department with STEM specialization, is unique in two respect: (1) the students take classes for training to teach undergraduate students (in contrast to teaching K-12 students as is usually done in Education Departments), and (2) carry out advanced research. The research would comprise a chapter of a Ph.D. thesis under the OSU advisor as the official co-advisor. The research is expected to continue as a long term collaboration. Under the program, a student while still in the Ph.D. program in India spends the first year at the OSU for education and for research and the second year in his/her Indian institution for field experience teaching undergraduate students and continuing research. The program was developed to address the need for better and effective educational foundations in India by Anil Pradhan and Sultana Nahar of the OSU Astronomy Department and Karen Irving of the OSU Education Department. It is funded by an Obama-Singh 21st Century Knowledge Initiative award of the US India Education Foundation (USIEF) that OSU received in partnership with AMU. India produces many excellent IT students, but they comprise only a small fraction of the 150 million students in need of better education.

To further the objective of expansion of the USIEF program to other institutions and to develop funding strategies, OSU organized with AMU the joint international conference on STEM Education and Research (STEMCON16) and Aligarh NANO-V in Aligarh during March 12-15, 2016. Various institutions in India, Bangladesh, Egypt, Russia, and the US participated. Ideas for combining teaching skills and scientific research were presented by the OSU participants, and were appreciated by the attendees from the scientific community. Presentations included internationalization of the program to developing countries, such as, Bangladesh, Egypt, Saudi Arabia, and the Republic of Georgia. The highlights of the program were communicated each day by the news media.

During this visit to India other institutions were visited to promote and expand the program. I gave public presentations, and also met with officials of government universities, such as the University of Kashmir, Central Kashmir University and Central University of Jammu, and private institutions, such as Sharda University near Delhi and Sri Mata Vaishnu Devi University in Jammu. The most attractive part of the program is the research under STEM disciplines and initiation and continuation of collaboration. One problem is the high cost of US tuition which is not supported by private institutions. Hence we are re-evaluating the scope of combining distant learning on-line courses. Our past experience for the distant learning course for the AMU students did not work well because of the communication time lag and unstable internet connections.

Under the STEM ER project, I taught a 3-weeks long condensed course on atomic astrophysics and conducted computational workshops on atomic processes at AMU. Participants were from the physics, chemistry, and computer science departments and received course certificates at the National Science Day celebration of the Physics Department.

At the same event physics prizes were awarded:

Best research to Professor Tauheed Ahmed

Best teaching to Professors Sabbir Ahmad and Abbas Ali and Professor Nasra Neelofar at the Women's college

Best Ph.D. Thesis to Best B.Sc. to Dr. Md. J. Alam (male), and Dr. L.A.A. Al-Khataby (female)

Best B.Sc. Student to Mr. S. Ahmad Shiekh (male), Ms. Fauzia (female)

At the University of Kashmir I also organized a compu-

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tational workshop on atomic processes which was attended by enthusiastic members from the physics and chemistry departments. The government imposed load shedding of electricity every day from 7 to 8 pm was a deterrent since we had to rush to wrap up before darkness. Also there were opportunities to work with female students and educators. We celebrated International Women's Day at AMU where 22 women were recognized. In Kashmir at the College for Women a student from Ladakh felt very much inspired and recited the Quran emotionally to express herself.

Sultana N. Nahar is a research professor in the Department of Astronomy at Ohio State University. 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.

Editor's Note. The award of the Obama-Singh award is described on page 9 of our fall 2013 newsletter.

The four students, Nida Rehmani, Hala, Malik Azeem, and Asim Rizvi in front and their OSU advisors in back form the "O-H-I-O" sign at the completion of all the requirements for the M.Ed degree of STEM

Inauguration session of the conference where Pradhan, Irving, and Nahar presented a summary of the STEM ER project.

Completion of the First Phase of a Major New Magnetic Fusion Experiment

Harold Weizner

The international magnetic fusion research and development program achieved a major milestone with the completion of the first phase of operation of the new W7-X stellarator facility at the Max Planck Institute for Plasma Physics in Greifswald, Germany. Almost all the magnetic fusion devices in the world confine a high temperature plasma in a torus by means of applied magnetic fields and in many cases with the addition of driven toroidal currents.

The more common tokamak confines its plasma in a nominally axisymmetric torus and magnetic field and requires substantial driven toroidal currents in order to maintain the equilibrium state. ITER, currently under construction in Cadarache, France, a major international collaboration, is a tokamak intended to operate with a net energy gain and provide the needed information to design a demonstration magnetic fusion power plant.

The stellarator design relaxes the restriction for an axisymmetric configuration and thereby can achieve plasma confinement in a torus without the need for large, driven toroidal currents. Aside from the intrinsic difficulty in driving such currents in near steady state, they also raise the possibility of generating harmful plasma instabilities. In addition to W7-X in Germany there is a close cousin of the stellarator, a heliotron, the Large Helical Device, in Japan. There are many other much smaller stellarators throughout the world. The two large experiments employ superconducting magnetic fields, and the Japanese experiment can confine a plasma for about an hour without difficulty. When one relaxes the constraint for an axisymmetric state, one finds a broad range of essentially different configurations of interest. This richness of options leads to the great diversity of experiments worldwide. With this the plethora of possibilities and the modest size of the worldwide program, international collaboration becomes a cornerstone of the work.

W7-X is the product of research stretching back to the 1950's, especially from a major experimental and theoretical program from the 1960's onward at the sister Max Planck Institute in Garching, Germany. Theoretical concepts and computational techniques developed there and in other parts for the world provided the basis for the "optimized" design of the facility. The design is intended to enhance the ability of the configuration to minimize plasma losses to levels comparable with those in a tokamak, such reductions being critical to ultimate reactor performance. The effectiveness of the design will be learned in continued operation of W7-X. Another goal is the study the long time behavior of confined plasmas in this configuration. The actual device is a torus of 16M across and 5M high. The mean major radius of the plasma is 5.5M, while its mean minor radius is 0.5M. The magnetic field can reach 3 Tesla and the ultimate plasma density will be about $2 \times 10^{20} / M^3$ Electron cyclotron heating of 9MW should produce a temperature of up to 10^8 K. The efficacy of such heating was demonstrated and pioneered in work at Garching.

The experiment started operation in December 2015 with a helium plasma. At that time the goals were to certify that the device met specifications, correct any problems and validate the diagnostics. The researchers and engineers were delighted to discover that essentially all specifications were met and the facility performed as hoped and expected. In February 2016 a formal inauguration of physics research on hydrogen plasmas was celebrated, with the attendance of German Federal Chancellor Dr. Angela Merkel. In the ensuing months a broad range of experiments were performed to study the plasma performance. In these experiments approximately 40% of the researchers came from other parts of Europe and 20% from the United States, thus manifesting the essential international character of the work. To date no unpleasant surprises have arisen. The plasma typically had a density of about $3 \times 10^{19} / M^3$ electron temperature of about 7 KEV, and a discharge duration time of up to 6 sec. While such parameters are not particularly noteworthy for a mature experiment, they represent a success for the facility as configured. In other laboratory plasma ex-

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periments, such performance has rarely, if ever, been achieved after only a few weeks of operation.

A major issue for all magnetic fusion machines is the maintenance of plasma cleanliness and development of means to enable plasma exhaust. These issues appear particularly complex for stellarators. In tokamaks one creates a so-called divertor on the outside of the plasma to exhaust waste and eliminate impurities. W7-X will explore the effectiveness of divertors for a stellarator. The initial configuration did not have a divertor, as one did not plan for an initial major experimental program.

A divertor is now being added to W7-X and operation will resume next year. At that time one expects much more robust performance from W7-X. It is expected that higher densities and much longer pulses and confinement times will result. In the meantime there is an active program underway to analyze the data obtained during the initial phases of the operation. One will be able to learn much about transport and plasma dynamics from this phase of operation.

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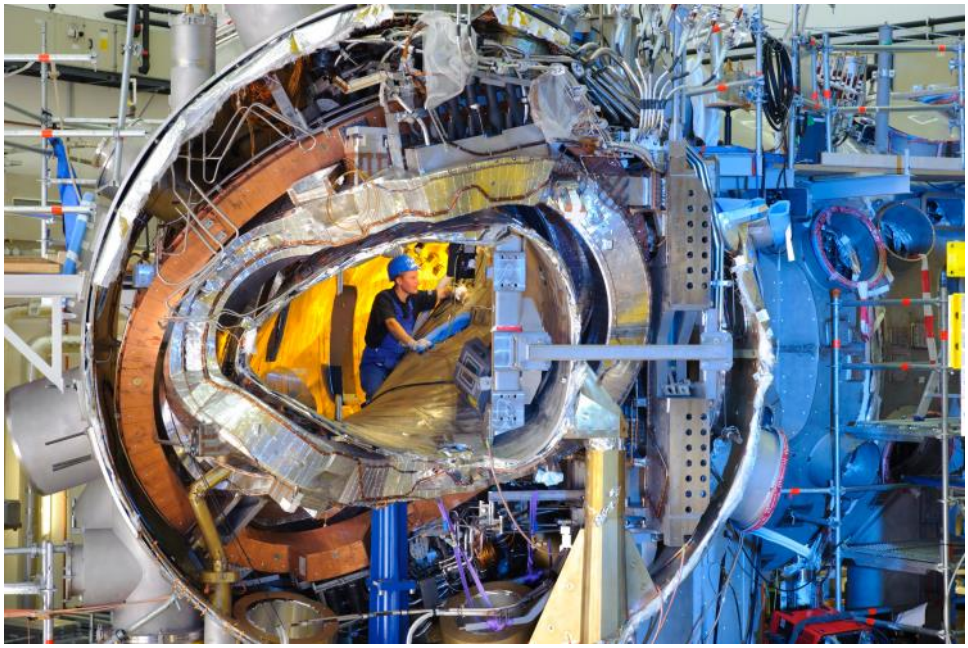
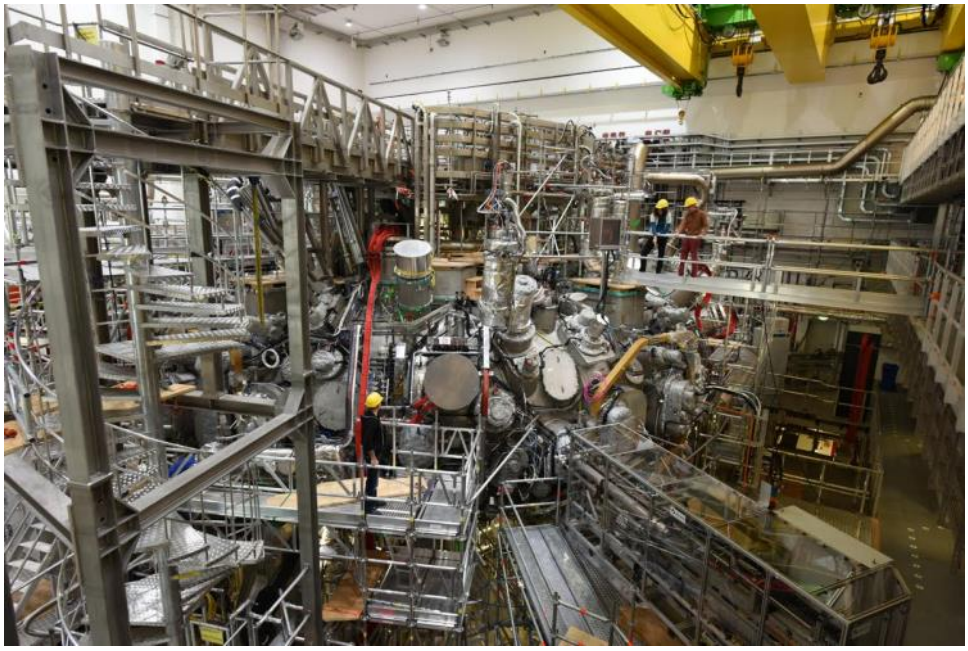


Exterior of W7-X under construction.

Credit: Wolfgang Filser.



Exterior W7-X as completed.

Credit: IPP

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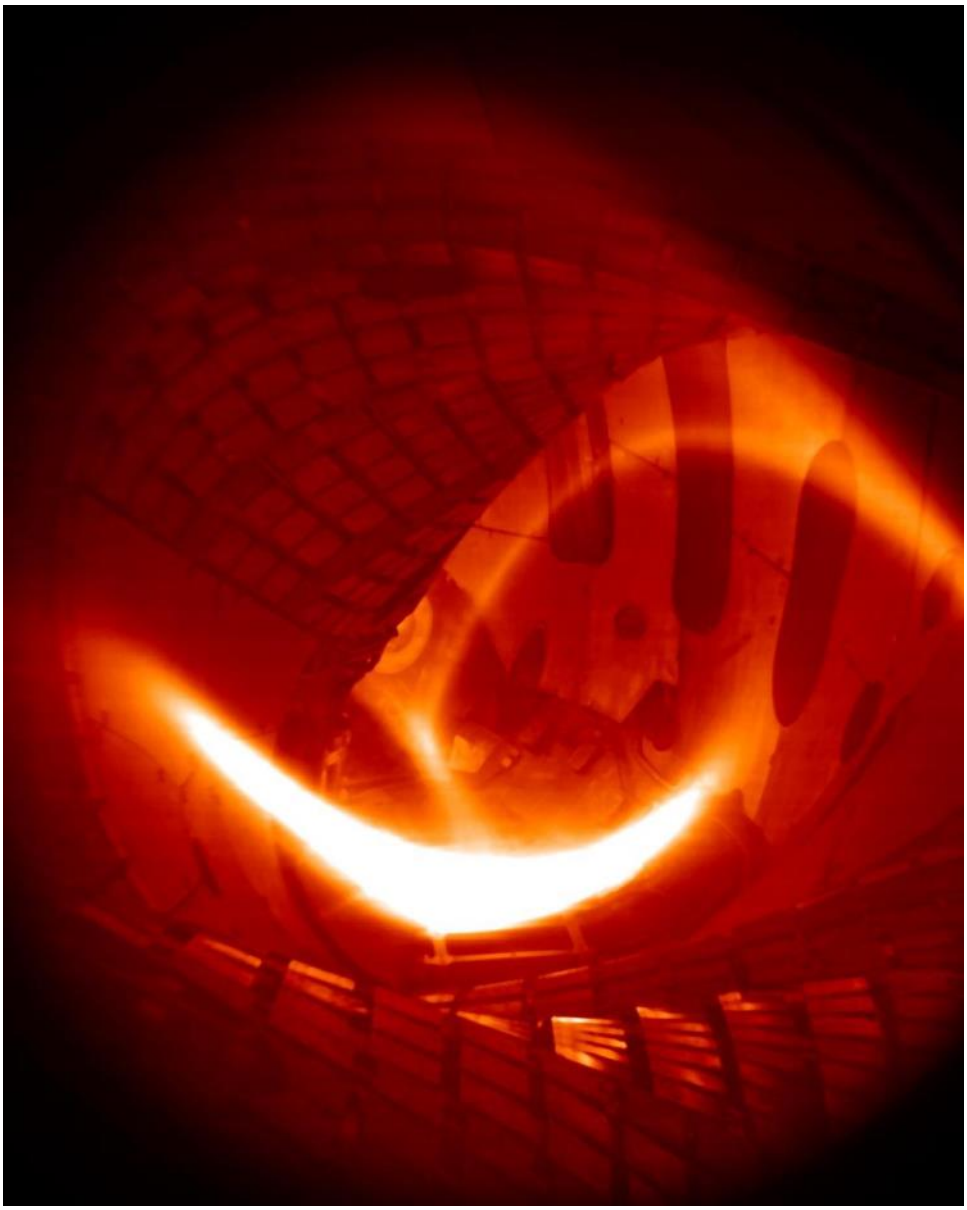
The longer term plans for W7-X include very long pulse operation at high densities and temperatures, with, one hopes and expects from theoretical considerations, long confinement times. Success in this ambitious project will make the stellarator a serious contender for a demonstration fusion reactor, which is intended to follow burning plasma studies on ITER. The future success of the stellarator project will depend heavily on continued international collaboration.



Plasma in W7-X. Credit IPP

Harold Weizner is Professor of Mathematics Emeritus at the Courant Institute of Mathematical Sciences, New York University

Editor's personal aside: Harold and I were roommates and fellow physics majors during our undergraduate years at UC Berkeley.

Plasma Physics in Canada

Michael Bradley

Plasma Physics in Canada is a research activity pursued across the country in both academic and industrial labs, and covers a wide range of thematic areas including fundamental physics of laboratory and space plasmas, laser-plasma interactions, plasma processing of materials, and plasma fusion research. These plasma research activities are united via two bodies, the Division of Plasma Physics (DPP) of the Canadian Association of Physicists (CAP), as well the regroupement stratégique Plasma-Québec.

Fundamental Plasma Physics: Theoretical plasma physics is a major research focus at the University of Saskatchewan. In parallel with the STOR-M tokamak (discussed in more detail below), Prof. A. Hirose led a group focused on fundamental plasma interactions in fusion plasmas, while Prof. A. Smolyakov maintains a robust effort in fundamental plasma physics, investigating turbulence in crossed field configurations (e.g. Hall thruster and Penning-type configurations), in collaboration with experimentalists at the Princeton Plasma Physics Laboratory and researchers in Cadarache, France. Many of these theoretical investigations make extensive use of the BOUT++ code, developed at the Lawrence Livermore National Laboratory in Livermore, California.

Space Plasma Physics: Several research groups at the University of Saskatchewan Institute for Space and Atmospheric Physics (ISAS- Profs. Hussey, Koustov, McWilliams, Sofko, and St. Maurice) are active in studying the plasma physics of the ionosphere and magnetic reconnection processes, using radar and satellite techniques. At the University of Alberta, Profs. Marchand, Rozmus, and Sydora maintain an active effort on space plasma physics the Department of Physics.

Plasma Processing: Materials processing applications of plasma physics are a major focus of researchers at McGill University, the Université de Montréal (UdeM), and the Institut National de la Recherche Scientifique (INRS), which are all located in the greater Montréal area. At the UdeM, the laboratory of Prof. Margot develops novel plasma sources and applications, while Optical Emission Spectroscopy (OES) of plasma discharges and innovative work on dielectric barrier discharges is carried out in the group of Prof. Stafford. A large group of researchers at the INRS Plasma Science and Applications Laboratory (directed by Prof. M. Chaker) are working on a variety of plasma processing techniques, with many focused on semiconductor applications. Also at the INRS, Prof. A. Pignolet leads a group focused on epitaxial thin films and nanostructured materials.

The Plasma Processing Laboratory at McGill University (Prof. S. Coulombe) focuses on plasma applications in non-fusion energy, nano-materials and nanostructured surfaces, and plasma source development.

Plasma materials processing is also a significant area of research at the University of Saskatchewan Plasma Physics Laboratory (UofS PPL), where Profs. Hirose and Xiao have pioneered plasma methods for the growth of carbon nanotubes and diamond-like carbon. Also, at the UofS PPL, Prof. Bradley's group has developed a Plasma Ion Implantation system for processing of photonic materials and other applications.

Plasmionique is a Montréal-based company focused on the development of innovative plasma processing systems including Inductively Coupled Plasma (ICP), microwave, and magnetron sputter deposition systems.

Meaglow Technologies is a company based in Thunder Bay, Ontario, focused on the development of hollow cathode plasma sources for Atomic Layer Deposition (ALD) applications.

Medical Imaging: Dense Plasma Focus: The Dense Plasma Focus team at the University of Saskatchewan (led by Prof. Chijin Xiao) is developing a dense plasma focus device for the production of PET imaging isotopes. This work is funded by the Syvia Fedoruk Canadian Centre for Nuclear Innovation.

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Laser-Plasma Interactions: A group in the University of Alberta Department of Electrical and Computer Engineering (Profs. Tsui and Fedosejev) focuses on laser-plasma interactions, including both pulsed laser ablation/pulsed laser deposition (PLA/PLD) as well lasers for warm dense matter and plasma fusion studies, in collaboration with researchers at Stanford/SLAC.

The LULI group (Julien Fuchs) at the École Polytechnique is also active in the use of laser plasmas for the study of plasma fusion as well as astrophysical phenomena.

Plasma Fusion: Canada has significant activity oriented toward plasma physics for fusion energy, despite the current lack of a national fusion program. Historically Canada had two operational tokamaks, the STOR-M tokamak at the University of Saskatchewan and the Tokamak de Varennes (TdeV).

The TdeV machine was mothballed in 1997, with various components being distributed to other labs. The TdeV program was important in the training of Canadian plasma physicists; indeed, the current director of the MIT Plasma Science & Fusion Centre, Prof. Dennis Whyte, is an alumnus of the TdeV effort. Canada also made a bid in the early 2000's to become the host nation for the International Thermonuclear Energy Reactor (ITER); however this effort was ultimately abandoned in 2004. After the TdeV closure and the ITER pullout, the STOR-M small tokamak (minor radius 12.5 cm, major radius 46 cm) at the University of Saskatchewan became the focus for tokamak research in Canada. Important milestones achieved at STOR-M include the first demonstration of AC tokamak operation, as well as innovative Compact Torus injection studies. STOR-M is also an active participant in the IAEA Co-ordinated Research Program (CRP) on "Joint Research using Small Tokamaks" and hosted teams from this collaboration for joint experiments in the summer of 2015.

Physics of the plasma edge and plasma-surface interactions were also the subject of study for many years by a team (Prof. Stangeby, Davis, Haasz) at the University of Toronto Institute for Aerospace Studies (UTIAS).

Canada also hosts some very innovative private-sector entrants in the plasma fusion category. Magnetized target fusion is being aggressively pursued by *General Fusion*, a private company founded in the early 2000s in the greater Vancouver area.

Conclusion: Plasma Physics in Canada is an active area of research supported by provincial and federal agencies, and also forms the focus for a number of private companies. Active research programs across the spectrum of plasma physics from fundamental studies to industrial applications to plasma fusion are being pursued by numerous groups across the country. Despite the lack of a national fusion energy program, plasma fusion in particular remains an active area of interest for many plasma researchers in Canada, and a number of innovative fusion concepts are being explored.

Dr. Michael Bradley is Vice-Chair, Division of Plasma Physics (DPP), Canadian Association of Physicists (CAP) and a member of the APS.

Shaping Africa by Education, and Information and Communication Technology

Christine Darve

Nothing is more amazing than the cultural diversity you encounter when you are at Istanbul airport, in the city between 2 continents. Like the large and growing diversity of the population, new societal challenges are also growing.

In the case of Africa, two different scientific solutions to societal challenges are of great interest: Education and ICT, Information and Communication Technology. The African population diversity and current geo-politics have created a complex environment in which to develop sustainable scientific achievements. Assuming that raising the standard of life in this vast continent will lead to a more stable world, then action must be taken right away.

Rwanda has become an interesting model. Following the 1994 genocide, twenty years of reconstruction have led to a new era. Economic growth is the second highest in Africa in 2016 and has advanced the country from a world ranking of 157 to 50. In addition to international support implemented in a rational manner, and security enforced throughout the territory, a major driver in this dramatic improvement is the rise of ICT.

Connecting Africa and enabling cheaper communication is a catalyzer to this progress. Also Africa has an amazing potential of youth to educate and develop ICT, the technology tools for tomorrow.

Rwanda University has been hosting international events that have demonstrated the country's commitment to promote science. Among several events (with over 100 participants), the University of Rwanda's College of Sciences and Technology just hosted the fourth biennial African School of Fundamental Physics and Applications, ASP2016, from August 1 to 19. (see the group photo in this newsletter issue)

Prof. Manassé Mbonye, the Principal of the College of Sciences and Technology, has announced that the College will host the fifth branch of the International Centre for Theoretical Physics, ICTP, based in Trieste, Italy. The new "East African Centre for Fundamental Research" will support activities throughout Africa.

Like the mission of the ICTP as well as that of ASP, AIMS (the African Institute of Mathematical Sciences), contributes to foster science in Africa. AIMS was founded in South Africa in 2003 by Neil Turok (born in South-Africa). AIMS has expended to Senegal, Ghana, Cameroon and Tanzania to train talented African scientists.

Education and innovation can address further difficulties. For instance, solar energy is a source of reliable and accessible electricity and can meet the community needs in a country like Rwanda, where 10.8 % of the population lacks access to electricity.

Dr. Marie-Christine Gasingirwa, Director-General of Science, Technology and Research at the Ministry of Education, and a member of the local organizing committee of ASP2016, cited education as a key to limit poverty and discrimination. Beyond the growing involvement of women in the Rwanda government (64% of the seats held by women in parliament) and in the sector of micro-financing, she illustrated the capacity to build based on science. She recalled the case of local grandmothers, who were sent to India for six months in 2012 to train as fully qualified solar engineers:

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"The training was provided through a partnership with Barefoot College in Tilonia, India, and implemented within the framework of the UNESCO Man and the Biosphere (MAB) program. After their return to the village in Rwanda, they installed the equipment for the school and houses, provided improved access to energy and security, and thus raised the quality of life for the whole community. They also gained the respect and recognition of their constituents due to the pragmatic attitude they learned."

Dr. Marie-Christine Gasingirwa at ASP2016

Those initiatives and innovations connect and transform the African landscape. Another vector of growth is the financial setting. The financial sector has been growing in recent years, and its stability, structure and efficiency has improved considerably in Rwanda and the rest of Africa.

"Investment in ICTs is essential in taking any country to the next level of productivity and efficiency. Investing in ICTs is not at the expense of other sectors. Investing in ICTs results in benefits for every sector and the earlier you start the better"

H. E. Paul Kagame
President of the Republic of Rwanda
Chairman of the Smart Africa board
(from Wikipedia)

Going beyond connecting Africa, one of the missions of the newly established "Smart Africa," based in Kigali, is to transform Africa by setting ICT at the center of national socio-economic development to promote a sustainable new era in Africa. Among large-scale innovative commitments, this organization facilitates the creation of new jobs supported by the development of 21st century skills. It also supports African students pursuing degrees and certifications at recognized centers of excellence throughout Africa that focus on ICT.

In other words, it sets a SMART objective, (**S**pecific **M**easurable **A**ssignable **R**ealistic & **T**ime-bound), which leaps towards greater integration of the African continent. Dr. Hamadoun Touré, the founding Executive Director of Smart Africa, is the former Secretary-General of ITU, the International Telecommunication Union. He is a driving force of ICT in Africa. Touré made a presentation at ASP2014, the third in the series, at Cheikh Anta Diop University in Dakar:

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Dr. Hamadoun Touré (from Wikipedia)

"Information and communication technologies are of crucial importance to all scientists around the world, and especially in Africa. Without ICTs, we cannot properly share large volumes of information, collaborate effectively, engage in technology transfer, or harness the power of grid computing. We have seen very solid progress in terms of increased internet use in sub-Saharan Africa, with more than two and a half times as many people online at the end of 2014 as there were at the end of 2009. The ICT sector in Africa has experienced quite extraordinary growth in recent years, especially in terms of mobile cellular communications – with penetration rates in sub-Saharan Africa almost doubling in the past five years, to reach 69.3% by the end of 2014. For instance, in Senegal, there are almost as many mobile cellular subscriptions as there are inhabitants. However, there is no denying that we still have far to go – with four fifths of people in sub-Saharan Africa still offline at the end of 2014. That's four fifths of the people on this fine continent who are denied access to the incredible wealth of knowledge and richness that the Internet can bring into our lives - and four fifths of the population that cannot properly engage in scientific research and innovation."

Education and ICT can be seen as the driver of the African future. An example has been ITU financial support to 5 young men and 5 young women from the Least Developed Countries during ASP2014.

"In Africa, in the 21st century, it is not enough to be smart; you need to be digitally smart."

Smart Africa is setting the goal. Dr. Didier Nkurikiyimfura, Senior Director at Smart Africa and former Director-General of ICT at the Rwanda Ministry of Youth and ICT, said that the optical fibers installed in Africa have transformed the African continent. Nkurikiyimfura explained:

> *"The Smart Africa board is composed of 13 African presidents, ITU's new Secretary-General and the African Union* ***Commissioner for Infrastructure & Energy****. One of the organization mandates is attract investment and leverage partnerships between governments, banks (World Bank, African Development Bank), the private sector, industries, and academics to transform Africa. "The strategic vision of this new-born organization is bridging the gap towards a new digital and safe era."*

The actors for the transformation of Africa are proactive; they are also composed of the young talented scientists, who are attending African schools, like Défi junior Jubgang Fandio, Cameroon, who is studying "Elliptic solitons in optical fiber media."

Dr. Didier Nkurikiyimfura and Defi junior Jubgang Fandio at ASP2016

Progressively, education and ICT are shaping new perspectives for Africa. Their success permits us to foresee a transformation of the African society and the opening of a new venue to raise the standard of our world.

Christine Darve is an Engineering Scientist in the Accelerator Division of the European Spallation Source in Lund. Dr. Darve has been the main organizer of the first biennial African School of Fundamental Physics and Applications. She is also a past member of FIP's Executive Committee.

Universities, one in Asia, one in Africa

These were referred to in the articles by Nahar and Darve.
Material derived from Wikipedia and Google images.

Aligarth Muslim University

Location: Aligarth, Uttar Pradesh, India
Academic Staff: 2,000
Students: 30,000

University of Rwanda

Location: Kigali, Rwanda
Academic Staff: 1,450
Students: 30,445

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