

# Reports from IUPAP Working Groups, for October meeting, 2013

Collected by Cecilia Jarlskog

The reports here below are from

- WG.1 - International Committee for Future Accelerators (ICFA)
- WG.5 - Women in Physics
- WG.7 - International Committee on Ultrahigh Intensity Lasers (ICUIL)
- WG.9 - International Cooperation in Nuclear Physics (ICNP)
- WG.11 - Gravitational Wave International Committee (GWIC)
- WG.12 - Energy
- IUPAC - IUPAP Joint Working Group

We have two more Working Groups:

WG.2 - Communication in Physics;

WG.10 - Astroparticle Physics International Committee (APPIC).

The reports from these groups will arrive later. The timing was not optimal for WG.2, and in the case of WG.10, the group is being formed, a process which will take some time. A very brief status report on WG.10 is included at the end of this report.

# WORKING GROUP 1

## Activities of the International Committee for Future Accelerators (ICFA)

September 2012 - September 2013

Roy Rubinstein - ICFA Secretary

### 1. Introduction

During the past year there were two ICFA meetings: on 21/22 February 2013 at TRIUMF, and on 26 June 2013 during Lepton-Photon 2013 in San Francisco. At the February meeting, which is the major annual ICFA meeting, directors of the world's leading particle physics laboratories were also invited, as has been the practice for the past ~ 2 decades. This allows a much more extensive discussion of the current and future status of particle physics.

The present ICFA membership is given in Appendix I.

### 2. Linear Collider

The Global Design Effort (GDE) and Research Directorate completed their mandates by producing the draft Technical Design (TDR) and Detailed Baseline Design (DBD) reports late in 2012. This was followed by a technical review of the International Linear Collider (ILC) accelerator and detector designs by an augmented Project Advisory Committee in December 2012. In February 2013, there was an international review of ILC accelerator costs. Changes recommended by these two reviews were incorporated into the final documents, which became publicly available at a world-wide "ILC Event" on 12 June 2013.

The International Linear Collider Steering Committee was set up in 2002 by ICFA to facilitate the global collaborative effort on the ILC. In February 2013, this committee went out of existence, and was replaced by the Linear Collider Board (LCB), which will oversee the activities of the Linear Collider Collaboration (LCC), comprising the ILC, the CLIC project, and the detectors for these colliders. ICFA produced a Mandate for the LCB, and has appointed its members. Lyn Evans was appointed Linear Collider Director, with Hitoshi Murayama as Deputy Director, Michael Harrison as ILC Associate Director, Steinar Stapnes as CLIC Associate Director, and Hitoshi Yamamoto as Associate Director for Detectors. Brian Foster and Harry Weerts have joined the LCC as Regional Directors, with an Asian Regional Director still to be appointed. Among the LCC goals are to support construction of a staged ILC in Japan.

### 3. ICFA Seminar

ICFA Seminars are held every three years, with the most recent being at CERN in October 2011, and the next one at IHEP/Beijing on 27-31 October 2014; these four-day Seminars allow for an international exchange of information primarily on plans for future facilities in the field of particle physics. Typical attendance is 150-200 invited leading members of the fields of accelerator and particle physics, together with leaders from related topics such as astroparticle physics, scientific computing, outreach, etc. Representatives of government funding agencies are also invited.

### 4. FALC

The Funding Agencies for Large Colliders (FALC) will produce a report on GDE activities over the past several years which have led to the ILC design, and how useful such a mechanism is for a future large global science project.

### 5. Neutrino Facilities

ICFA created a Panel on neutrino facilities, limited to an accelerator-based program, but which will also look at related non-accelerator based neutrino activities; a charge for this Panel was produced.

### 6. ICFA Chair

Pier Oddone retired as Fermilab Director and ICFA Chair on 1 July 2013. ICFA agreed that the incoming Fermilab Director, Nigel Lockyer, would serve as ICFA Chair for the remainder of Oddone's term, which ends on 31 December 2014.

### 7. Reports

Reports were presented to ICFA meetings on the activities of ICFA's Panels; the ICFA/ICUIL collaboration on particle acceleration by lasers; and of each country and lab represented at the meeting. There were also reports given on InterAction (the particle physics communicators' organization).

Appendix I

**ICFA MEMBERSHIP**

September 2013

CERN Member States

R. Heuer  
M. Krammer  
J. Mnich

USA

N. Lockyer (Chair)  
D. MacFarlane  
I. Shipsey

Japan

T. Mori  
A. Suzuki

Russia

A. Bondar  
S. Ivanov

Canada

W. Trischuk

China

Y. Wang

Other Countries

G. Alves  
A. Roy  
V. Tsakanov

C11

H. Aihara

(Secretary: R. Rubinstein)

# WORKING GROUP 5

## Report on the activities of the IUPAP Working Group on Women in Physics, 2012-2013

The Working Group on Women in Physics was formed by resolution of the Atlanta IUPAP General Assembly with the following mandate:

- to survey the present situation and report to the Council and the liaison committees
- to suggest means to improve the situation for women in physics.

One of the main activities of the Working Group is the organization of the International Conferences on Women in Physics (ICWIP) that take place once every three years. At these conferences experiences and data from a large number of countries are exchanged. During the last year the editing of the 2011 ICWIP Proceedings was finalized. The proceedings are now available at: <http://proceedings.aip.org/resource/2/apcpcs/1517/1?isAuthorized=no>

During 2012 we received proposals from Canada and Ecuador to hold the forthcoming 2014 International Conference on Women in Physics. Taking into account that the previous conferences took place in Europe, Latin America, Asia and Africa we decided to have it in Canada. In preparation for the conference we had a Working Group meeting in Waterloo, Canada, in June 2013. On that occasion, we visited the premises where the conference is going to be held and discussed the conference organization. In particular, the conference is being co-organized by the IUPAP Working Group on Women in Physics and the Canadian Association of Physicists with the collaboration of the Perimeter Institute (<http://www.perimeterinstitute.ca/>). The conference will be held from August 6 through August 8, 2014, at the Wilfrid Laurier University (<http://icwip2014.wlu.ca/>). It will include 6 plenary talks, 5 Workshops, outreach activities, a country poster session where country teams will present information on the current situation of women physicists and a scientific session where participants will present the results of their scientific research. Regarding plenary talks, the following speakers have confirmed their participation: Fabiola Gianotti (former spokesperson of the ATLAS experiment at CERN) from Italy, Silvia Torres-Peimbert (President elect of the International Astronomical Union) from Mexico, Sabine Stanley (Professor at the University of Toronto) from Canada and Tsai-Chien Chiang, author of the book *Madame Chien-Shiung Wu: The First Lady of Physics Research* (see e.g., <http://cerncourier.com/cws/article/cern/51556>) who will talk about Madam Wu. In connection to this activity, the publisher of the book has agreed to give out 300 copies of it to attendants of the conference. Regarding the conference organization, we are now in the process of raising funds to support the travel of attendants from developing countries so as to guarantee that as many countries as possible are represented at the conference. In particular, we are requesting financial support from IUPAP in a separate letter. This support will be very important given the financial restrictions that most countries are facing. We are also communicating with previous country team members so that they put together teams that can attend the conference, encouraging them to apply for funds in their own countries or regions. Finally, we are in the process of organizing the workshops of the conference that will cover the following topics: Gender Studies, Physics Education, Improving the workplace, Professional

Development and Leadership, Cultural perception and bias/ Science Practice and Ethics.

Another important activity of the Working Group is to give out grants to fund the travel expenses of women physicists from developing and Eastern European countries that are willing to attend scientific conferences and schools. In 2013 a new call for Travel Grant Applications was launched. Sixty-five applications were received and 15 Travel Grants were awarded (for the list of awardees, please see <http://wgwip.df.uba.ar/iupap-grant-2013.htm>).

We contacted the American Institute of Physics regarding the analysis of the Global Survey of Physicists that was answered by about 15000 physicists from around the world. So far, the data collected has been analyzed partially (see e.g., [http://www.physicstoday.org/resource/1/phtoad/v65/i2/p47\\_s1?bypassSSO=1](http://www.physicstoday.org/resource/1/phtoad/v65/i2/p47_s1?bypassSSO=1)). For our Working Group knowing what were the differences across regions was of particular interest. After contacting Rachel Ivie from AIP she finally found a way to finalize this analysis, which will be done by the end of the year with funds from AIP. Having a thorough and complete analysis of this data will be most helpful to advance the agenda of our Working Group. In particular, it will help us suggest ways to improve the situation of female physicists and increase the number of women in the field.

We are still in the process of looking for people that can join the Working Group who are from regions that are under-represented in the group. We have also made some decisions on how to replace some of our members that have been part of the Group for a relatively long time. In that regard, we have invited Prof. Kwek Leong Chuang from Singapore who has accepted to join the group during ICWIP replacing Jin-Hee Yoo and Youngah Park from Korea.

Finally, we would like to mention that none of our activities would be possible without the continuous help of Jacquelyn Beamon-Kiene.

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Jacquelyn Beamon-Kiene (secretary and financial manager) ([beamon@aps.org](mailto:beamon@aps.org))

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Jin Hee Yoon , Korea, [jinyoon@inha.ac.kr](mailto:jinyoon@inha.ac.kr) (associated member)



# WORKING GROUP 7



# Annual Report to IUPAP September 2013

[www.ICUIL.org](http://www.ICUIL.org)

## ICUIL Activity Overview

The International Committee on Ultra-High Intensity Lasers continues to be engaged with the growth and vitality of the whole international field of ultra-high intensity lasers. Our goals are to provide a venue for discussions, among representatives of high-intensity laser facilities and members of user communities, on international collaborative activities such as the development of the next generation of ultra-high intensity lasers, exploration of new areas of fundamental and applied research, and formation of a global research network for access to advanced facilities by users. As summarized in the highlights of this report, ICUIL has been very active in promoting collaborations required to design and build high-intensity laser infrastructures for the advancement of the international physics community.

### ICUIL Board

**Chair**  
*Toshiki Tajima*

**Co-Chairs**  
*Chris Barty*  
*Alexander Sergeev*

**Secretary**  
*Terry Kessler*

**Treasurer**  
*Tsuneyuki Ozaki*

## ICUIL Biennial Conferences

ICUIL has a decade-long history of promoting unity and coherence in the field by convening conferences dedicated to ultra-high intensity lasers and their applications. The 6th biennial ICUIL conference will be held **September 16-21 in Goa, India** and will be hosted by the **Tata Institute of Fundamental Research**, with R. Kumar serving as the conference chairman. It will be located in the city of Goa, on the west coast of India, about 600 km south of Bombay. Attendees will be able to visit the Tata Institute of Fundamental Research (TIFR), the Bhabha Atomic Research Centre (BARC) and the Raja Ramanna Centre for Advanced Technology (RRCA). TIFR has an operational 100TW laser system focusing on basic intense laser science and applications while RRCAT has a 150 TW system for laser particle acceleration. BARC will soon have a 200 TW laser system.

## 2013 Annual General Assembly (GA) Meeting

A twelve member quorum was reached at the annual GA meeting held in Livermore CA, US on July 18<sup>th</sup>. The agenda for the meeting consisted of member rotation, the 2014 ICUIL Conference, website development, the world map, fund raising, and laser infrastructure initiatives and collaborations such as ELI, XCELS, and IZEST. The role of educational institutions in addressing the high demand for individuals trained in laser science, engineering, and technology was discussed. Bi-monthly teleconferences continue to be effective in maintaining progress in each of these activities.

## ICUIL Member Rotation

Several of the current ICUIL members will have completed two terms of service by 2016 and will be required to step down according to the bylaws of the ICUIL charter. A phased member rotation in 2014 is being planned to provide continuity. Member rotation has been carried out, in small steps, to maintain continuity and ensure that ICUIL continues to advance while maintaining balance both geographically and between the various high



field science working groups of IUPAP.

### ICUIL Newsletter

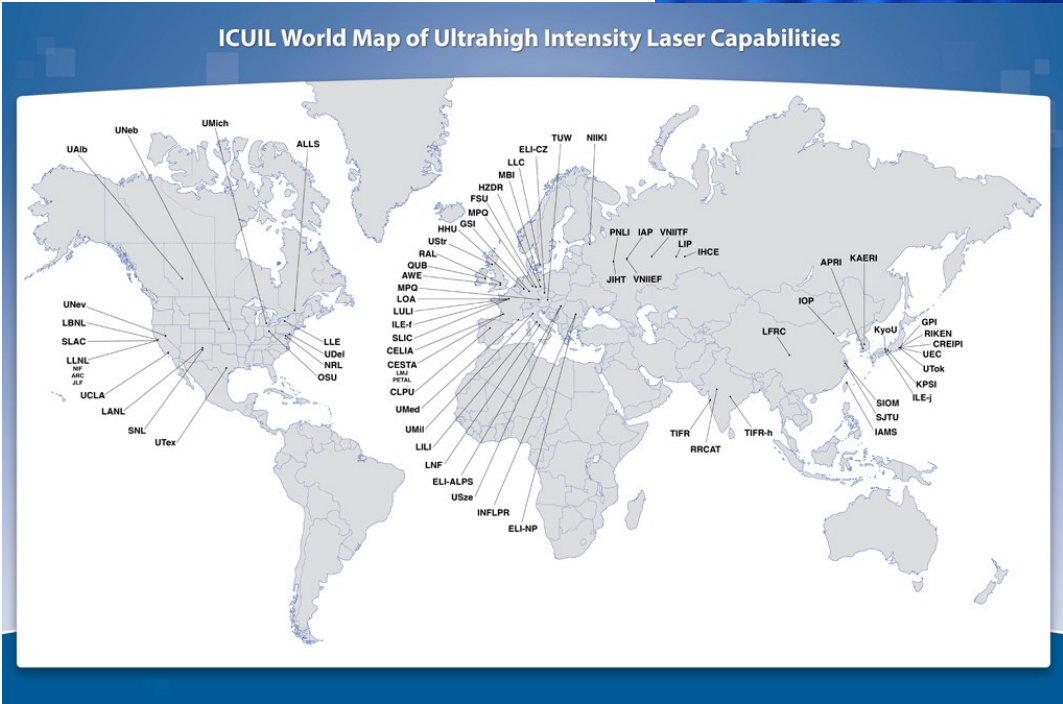
The fourth ICUIL Newsletter (Volume 4) was sent out to the high intensity laser community on May 2013 and is also available at the ICUIL website. The chief editor, C. Labaune, managed the illustration and publication resources to distribute an eight-page newsletter to hundreds of readers, highlighting the major laser construction and laser science projects within the HIL community, major conferences, and related workshops. ICUIL's goal is to continue publishing an annual newsletter.

### Fund raising

ICUIL has continued its corporate support program to afford maintenance of the ICUIL website, publish an annual newsletter, and support biennial conferences. The remaining funds are being targeted towards support of new outreach activities including student competitions held at the biennial conferences.

### ICUIL Website

One of the features of the ICUIL website is an interactive world map that highlights the high intensity laser facilities around the world as shown below. A survey of the worldwide laser community has been conducted by ICUIL in an effort to provide an accurate accounting of all existing and planned ultrahigh intensity laser facilities that are capable of reaching intensities above  $10E19$  W/cm<sup>2</sup>. The map (shown below) exists on the ICUIL web site both in downloadable, high quality static form and also as a dynamic interactive map based on an underlying Google-Maps engine that has been licensed by the Lawrence Livermore National Laboratory for this purpose. The data base generated in the creation of the ICUIL world map reveals that ICUIL related activities are growing worldwide at an incredible pace. In 2009 the sum of the peak power from all existing ICUIL related facilities was 12 PW. Survey data suggests that by 2015 this number will be over 100 PW.



**2013 ICUIL Membership**

Toshiki Tajima	Chairman	International
Chris Barty	Co-Chairman	United States
Alexander Sergeev	Co-Chairman	Russia
Terry Kessler	Secretary	United States
Tsuneyuki Ozaki	Treasurer	Canada
Gerard Mourou		France
Hiroshi Azechi		Japan
John Collier		United Kingdom
Dino Jaroszynski		United Kingdom
Thomas Kuehl		Germany
Ravi Kumar		India
Christine Labaune		France
Wim Leemans		United States
Ruxin Li		China
Chang Hee Nam		Korea
Bedrich Rus		Czech Republic



Wolfgang Sandner  
Heinrich Schworer  
Ken-ichi Ueda

Germany  
South Africa  
Japan

Associate Members (without vote)

Ryosuke Kodama  
Jong-Min Lee  
Sandro de Silvestri  
Nilson Dias Vieira Jr.  
Claes-Goran Wahlstrom

Japan  
Korea  
Italy  
Brazil  
Sweden

## ICUIL Related Science and Technology Highlights

### I. ICFA/ICUIL Joint Task Force (JTF)

ICUIL and ICFA have exercised their Joint Task Force (JTF) on future applications of laser acceleration to promote and encourage international collaboration between the accelerator and laser communities. The JTF outlined a roadmap for advancing laser technology to meet the challenge of future accelerators that use or rely on very high-average power lasers. Following two workshops, a document describing the recommended future course of actions was published in the ICFA Newsletter. The laser driven acceleration approach is paving a way to help a variety of high-energy accelerator physics issues such as the future high-energy collider, ion beam sources, electron beam source for FEL, and compact ion beam cancer therapy application. Although the scientific case for the laser based accelerator is compelling, the technological requirements are challenging. One of the most urgent needs for development is an efficient high-average power laser technology. In order to meet these recommendations and challenges, a project called International Coherent Amplification Network (ICAN) between the laser and accelerator communities was launched last year. This network has identified the fiber laser as the primary candidate for achieving highly efficient, high-average power lasers in the future. In an 18-month pilot project funded by the EU, 64 fiber lasers were coherently combined to form one laser beam. An article describing the extension of this laser technology for accelerator physics appeared in *Science*, Volume 341, on August 16, 2013.

The EC has launched a new initiative centered at CERN by forming European Network for Novel Accelerators, encompassing a few dozen accelerator and laser institutions worldwide. At the last IPAC2012 meeting in New Orleans a meeting was held with the ICFA Advanced and Novel Accelerator Panel. CERN representatives have expressed interest in the ICAN initiative and would consider providing space for a test facility. A description of where ICAN is positioned within the context of new accelerator techniques was requested by CERN Director General, Rolf Dieter Heuer.

### II. Extreme Light Infrastructure (ELI)

Extreme Light Infrastructure (ELI), the world's first international user facility for laser research, was established as an International Association on April 11, 2013 in Brussels, Belgium. The event was attended by representatives from the European Commission and various ELI partner countries. ELI is part of the European Strategy Forum on Research Infrastructures (ESFRI) roadmap for international research infrastructures of high priority for Europe. Based on strong international collaborations it is being constructed in three countries utilizing EC Structural Funds. In the Czech Republic, *ELI-Beamlines* facility will provide a variety of petawatt scale laser capabilities that will enable creation of secondary, laser-driven particle and light sources for basic science and industrial applications. In the Romanian *ELI-Nuclear Physics* facility, two 10 PW lasers are planned to be constructed in conjunction with a world-leading gamma-ray source to investigate a wide range of nuclear science. In Hungary, the *ELI-ALPS* facility will concentrate on the development and applications of intense sources of attosecond laser pulses. With its ultra-intense and ultra-short pulses of light it will create new states of

matter in dense plasmas, probe the structure of vacuum and produce secondary radiation of high-energy photons or particles.

A new legal entity, the *ELI-DC Association*, was created in order to manage and support the implementation of the existing and future ELI research centers and to preserve the pan-European dimension of the overall project. It will also organize the establishment of an international consortium that will be in charge of the future operation of ELI, preferably in the form of a European Research Infrastructure Consortium (ERIC). ICUIL member Wolfgang Sandner is its designated Director General.

### **III. Exawatt Center for Extreme Light Studies (XCELS)**

XCELS is one of the six mega-science projects that were chosen by the RF Government on a competitive basis in 2011. This initiative is analogous to ESFRI in that it requires participation in constructing and exploiting research complexes of foreign partners. A scientific Workshop, “The Laser Ascent to Subatomic Physics and Applications” took place at the French Embassy in Moscow on April 26. Memoranda of collaboration in the area of extreme light between CEA, Ecole Polytechnique and IAP, and between CEA, Ecole Polytechnique and Russian National Nuclear University (MEPHI) were signed during this workshop. It was organized by the Embassy of France in Russia together with the IZEST and the Institute of Applied Physics of the Russian Academy of Sciences. About 70 scientists, from Russia, France, other European countries, China and Taiwan participated in the event and agreed to promote creation of XCELS, IZEST, collaboration between French and Russian research laboratories in the area of extreme light science, application, and technologies and partnership of appropriate laboratories to form consortia capable of performing complementary research.

Construction of the fourth ELI center containing the world’s most powerful subexawatt laser complex is currently pending and represents a common goal with the XCELS project. This cooperation opens up a unique opportunity for EC countries to implement the full ELI project and for Russia to become an equitable partner of the European scientific community. A legal form of Russian participation in the ELI+XCELS alliance may involve an associated membership in the ERIC. On June 19, the second evaluation meeting took place at the EC headquarters in Brussels, where the EC appointed experts, Susana Gota Goldman (CEA) and Wolfgang Sandner (ELI), fully supported the ELI+XCELS alliance.

### **IV. International Center for Zetta-Exawatt Science and Technology (IZEST)**

IZEST, headquartered at the Ecole Polytechnique, will unify a number of exawatt class facilities such as the ELI-Fourth Pillar, the Russian XCELS, as well as possible Japanese and Chinese exawatt lasers. The initial experimental program will be performed by using the most powerful European laser PETAL at the CEA-CESTA in Bordeaux and the Russian Exawatt once completed, but most of the preparatory activities will be carried out in the IZEST-associated laboratories around the world. Almost 30 laboratories in 13 countries have signed a collaboration agreement with IZEST. The second IZEST meeting was held November, 2012 at Strathclyde University, Scotland. The meeting included a presentation from Peter Higgs as a distinguished speaker, and many other prominent speakers. The main objective of the conference was to explore the potential of very high fields available from the next generation of high power lasers and also the potential of combing them with high



energy particle beams from laser-plasma accelerators, for fundamental studies of the structure of matter. The third IZEST meeting was held at the Lawrence-Livermore National Laboratory in July, 2013 to discuss the development of novel exawatt and zettawatt laser technologies and the development of frontier, ultrahigh intensity science and applications. The main mission of the International IZEST center is to position the scientific community behind this proposal to use the laser field to probe the nonlinearity of vacuum.

## **V. Shanghai Institute of Optics and Fine Mechanics (SIOM)**

In China, Ruxin Li from the State Key Laboratory of High Field Laser Physics, is pursuing the challenge of producing laser intensities in the ultra-relativistic regime, where laser pulses with peak power of 10 PW level and beyond are necessary. Laser amplification in Ti: sapphire has led to generation of 1.5PW laser pulses. With successful control over the parasitic lasing, his group obtained a record energy of 72.6 J from a Ti: sapphire of 100mm size, corresponding to a record power of 2PW after the amplified chirped pulse is compressed to 26 fs. This represents an important step forward in the development of ultra-high intensity laser sources based on the scheme of CPA. For the realization of 10PW and beyond, the optical parametric chirped pulse amplification (OPCPA) scheme is a promising alternative approach. In contrast to CPA where the laser energy is gained due to the laser action based on population inversion in laser materials, OPCPA is based on the parametric amplification in nonlinear optical crystals. They demonstrated the highest energy broadband OPCPA at 800nm by using a 80-mm in diameter  $\text{LiB}_3\text{O}_5$  (LBO) crystal, with an output energy 28.68 J, a bandwidth of 80 nm (FWHM) and a conversion efficiency of 25.8%. After pulse compression, the peak power of 0.61 PW was produced.

## **VI. Center for Relativistic Laser Science (CoReLS)**

In Korea, the Institute for Basic Science (IBS) opened the Center for Relativistic Laser Science. The Korean national nine-year program, Ultrashort Quantum Beam Facility (UQBF) Construction Program, was successfully completed in 2012 and has started an international users' service. The Korean government is now forming a national plan for applied research projects using this facility. When fully installed, IBS will comprise 50 research centers, each of which focuses on a selected research topic in basic science. One of the earliest research centers is the Center for Relativistic Laser Science (CoReLS), which explores the superintense laser-matter interaction. CoReLS's research is focused on the understanding of physics under extreme conditions induced by superintense laser fields. The goal is pursued cooperatively by the five research groups of CoReLS: laser group, low-density laser-plasma group, high-density laser-plasma group, atto science group, and laser-plasma theory group. CoReLS is directed by Prof. Chang Hee Nam who has pioneered the development of advanced femtosecond laser technology and atto science in Korea. Two petawatt beamlines: 1.0 PW and 1.5 PW at 30 fs, the latter being the most powerful femtosecond laser as of 2012, were developed by the UQBF project and led by Prof. Jongmin Lee. Enthusiastic researchers are joining from around the world.



# WORKING GROUP 9

# Nuclear Physics Research: An International Perspective

## Introduction

A working group set up under the auspices of the International Union of Pure and Applied Physics (IUPAP) is taking a forward look from an international perspective at nuclear physics and the facilities it uses. IUPAP was established more than 90 years ago (in 1922) to foster international co-operation in physics. It does this through the activities of a number of commissions for different areas of research, including the Commission on Nuclear Physics (C12), established in 1960. In addition through various commissions working groups were set up with specific mandates. Well known are the International Committee for Future Accelerators (ICFA) formed in 1976 with a link to the Commission on Particles and Fields (C11) and the Working Group on International Cooperation in Nuclear Physics formed in 2005 with a link to Commission C12 (Working Groups WG.1 and WG.9, respectively).

The membership of IUPAP WG.9 was chosen to constitute a broad representation of geographical regions and nations with expertise in the various subfields of nuclear physics, as one would expect for a working group of IUPAP. Its membership consists of the working group's chair, immediate past-chair, and secretary; the chairs and immediate past-chairs of the Asia Nuclear Physics Association (ANPhA), of the Nuclear Physics European Collaboration Committee (NuPECC), and of the Nuclear Science Advisory Committee to the US DoE and NSF (NSAC); the chair of the Latin-America Association for Nuclear Physics and Applications (ALAFNA); the directors of the large nuclear physics facilities (four each from Asia, Europe, and North-America, plus one from South-Africa); and the chair of IUPAP C12. The IUPAP WG.9 working group meets every year just prior to, the Annual General Meeting (AGM) of IUPAP C12. In addition, IUPAP WG.9 has the task to organize the triennial two-day Symposium on Nuclear Science and Nuclear Physics Facilities.

The chief tasks of IUPAP WG.9 are to answer the three specific questions:

- What constitutes nuclear science from an international perspective?
- Which are the facilities that are used to investigate nuclear physics phenomena?
- Which are the scientific questions that need to be addressed at these and future facilities.

The answers to these questions appear in IUPAP Report 41, published in hard copy in 2007 and is posted on the website:

<http://www.triumf.info/hosted/IUPAP/icnp/index.html> ,

However, the document requires regular updating. IUPAP Report 41 contains entries for all nuclear physics user facilities that agreed to submit data. The 92 entries range from smaller facilities with more restricted regional usage to the large nuclear physics

accelerator laboratories with a global users group. The report also contains an overview of the major scientific questions facing nuclear physics today, together with a summary of how these questions are being addressed by the current nuclear physics facilities or how these questions will be addressed by future and planned facilities. There is also a short account of the societal benefits stemming from the basic advances in nuclear physics with its underlying high technology developments and of the energy question of such great importance for the evolution of society.

IUPAP WG.9 is operating following a mandate given by the OECD Global Science Forum, (GSF). In 2008, IUPAP WG.9 gave expert advice to the OECD GSF Working Group on Nuclear Physics. It became apparent that for science policy makers in many countries it is essential to understand how proposals for future large nuclear physics facilities fit within an international context. The OECD report provides a global roadmap for nuclear physics in the current decade in a format suitable to science administrators.

### **The 2013 Nuclear Science Symposium**

In response to the mandate given to IUPAP WG.9 by the OECD GSF a second two-day nuclear science symposium was organized at the Laboratori Nazionali di Frascati, May 31 – June 1, 2013. The symposium provided the opportunity for proponents of nuclear science across the world to learn about and discuss present and future plans for research in nuclear physics, as well as upgraded and new research facilities that will be required to realize these plans. Three half-day presentations were arranged by the executive of IUPAP WG.9.

The presentations at the symposium focused on seven main topics of nuclear physics today:

1. “Can the structure and interactions of hadrons be understood in terms of QCD?”.
2. “What is the structure of nuclear matter?”,
3. “What are the phases of nuclear matter?”,
4. “What is the role of nuclei in shaping the evolution of the universe, with the known forms of matter only comprising a meager 5%?”,
5. “What is the physics beyond the Standard Model?”,
6. “What is the role of nuclear physics in serving society?”,
7. “What is the role of nuclear energy in the global energy question?”.

The presentations are available at

<http://www.triumf.info/hosted/IUPAP/icnp/index.html>

and are briefly summarized below:

- “QCD and Hadronic Nuclear Physics (hadrons and nucleons)”  
Since the last symposium in 2010 considerable progress has been made in

elucidating the intricate structure of the nucleon, but there is a wealth of exciting, fundamental questions that need to be addressed in turn.. Experiment, phenomenology, and lattice QCD appear to be working together beautifully. It needs to be emphasized that appropriate investments are needed to exploit the facilities now operating and nearing completion. To further the field an electron-ion collider requires being build and high power computers are necessary for lattice QCD.

- “QCD and Quark Matter”

The higher priority for quark matter research is the full exploitation of the physics potential in colliding heavy ions at the LHC. At lower energies where the highest baryon densities are reached, there are opportunities for a new generation of precision measurements that address central questions about the QCD phase diagram. The complementarity of LHC and RHIC is an essential resource in efforts to quantify properties of the Quark-Gluon Plasma.

- “Electroweak Physics and Fundamental Symmetries”

Fundamental symmetry tests probe new physics at the PeV scale and already severely constrain the flavor and CP structures of any scenario addressing the hierarchy question. If a positive signal is found it would not point to a specific theory or model. It is therefore of paramount importance to pursue as many different types of symmetry tests as possible [B, L, LF, CP, P conservation] and then within each type of symmetry test study various kind of processes, like  $\mu \rightarrow e \gamma$ ,  $\mu \rightarrow 3e$ ,  $\mu - e$  conversion, and where possible deduce final state information, like spin, flavor, energy. The subfield is moving towards being the primary search vehicle for new physics if nothing (except for the Higgs) is discovered at the LHC.

- “Low Energy Nuclear Structure and Nuclear Astrophysics”

The study of atomic nuclei provides the connection between the fundamental building blocks of matter, complex nuclear systems, and the cosmos. The last three years has seen considerable progress in the physics of nuclei and the interconnection with nuclear astrophysics. Existence of the super heavy elements with atomic numbers between 112 and 118 has been found and confirmed. Great progress has been made in a comprehensive and validated theory of nuclei from the light nuclei to medium-weight nuclei to heavy nuclei.

- “Nuclear Physics Serving Society”

Nuclear technology, nuclear processes, and nuclear data play an essential role throughout modern society. The use of radioactive nuclei for diagnostic purposes or treatment purposes is prevalent in and essential and critical for modern medicine.

- “Nuclear Energy”

Nuclear energy is still perceived as a clean and economical source of energy, but a new approach to safety and sustainability is needed. Developing countries have taken the lead role in the construction of new nuclear power plants. The future of the nuclear fuel cycle is a most important issue. Accelerator driven systems for power generation and nuclear waste management has a major window of opportunity. But economics will drive the future of nuclear energy and nuclear waste management.

- “Nuclear Physics Facilities”

The present and near completion nuclear physics facilities plus those presently under construction give great promise to answer the questions outlined in the above -listed presentations. For hadrons and nucleons and QCD – Jlab [12 GeV], J-PARC, and FAIR. For quark matter – LHC-ALICE, RHIC, FAIR. For nuclear structure and nuclear astrophysics – FRIB, RIKEN-RIBF, GANIL-SPIRAL2, LNL-SPES, CERN-HIE-ISOLDE, TRIUMF-ISAC, ALTO at IPNO, as well as rare isotope beam facilities under construction in China – CSR in Lanzhou, BRIF in Beijing, HIAF in Lanzhou, and in Korea (RAON-RISP). There is also in the planning stage EURISOL. Tests of fundamental symmetries range from table-top experiments to extended experiments at the large nuclear physics facilities.

The presentations led to extensive discussions among the various representatives. At the Symposium two separate ‘in camera’ meetings were arranged for science administrators/government representatives.

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Willem T.H. van Oers  
Secretary of IUPAP WG.9  
TRIUMF, June 24, 2013

# WORKING GROUP 11

# Gravitational Wave International Committee (WG.11)

## report to IUPAP

28 August 2013

(prepared by Stan Whitcomb, Caltech [Secretary]  
and Eugenio Coccia, University of Rome "Tor Vergata" [Chair])

The Gravitational Wave International Committee (GWIC) was formed in 1997 to facilitate international collaboration and cooperation in the construction, operation and use of the major gravitational wave detection facilities world-wide. From 1999 until 2011, GWIC was recognized as a subpanel of PaNAGIC (IUPAP WG.4). In 2011, GWIC was accepted by IUPAP as a separate Working Group (WG.11). This was judged to be possible without any change to the remit or the by-laws of GWIC. Since its founding, GWIC has included representation from the International Society on General Relativity and Gravitation (AC2) and from the astrophysics/theoretical relativity community. GWIC agreed to accept representation from other interested IUPAP commissions and working groups, and to provide cross-representation for APPIC (WG10) and to other IUPAP commissions as requested.

GWIC meets annually adjacent to an appropriate conference, with recent meetings in Warsaw (2013), Rome (2012), Cardiff (2011), Hannover (2010), Pasadena (2009), New York City (2009), and Pisa (2008). Other business during the year is conducted via email or other electronic communication.

GWIC maintains a website at <https://gwic.ligo.org/> which contains an up-to-date listing of members, its by-laws, announcements of its activities, and links to other items of interest to the gravitational wave community.

### **GWIC Membership**

The membership of GWIC represents all of the world's active gravitational wave projects, as well as other relevant communities, covering gravitational wave frequencies from nanohertz to kilohertz. Each project has either one or two members on GWIC depending on size. GWIC also includes representatives from ISGRG (IUPAP AC2) and from the astrophysics/theoretical relativity community.

Each member project in GWIC determines its representatives on GWIC. In this year, five member projects appointed new representatives: ACIGA (Peter Veitch), KAGRA (Yoshio Saito), LISA (Neil Cornish), NANOGrav (Rick Jenet), and PPTA (George Hobbs). In addition, Beverly Berger was appointed by AC2 as its representative.

The GWIC Chair is elected by its membership at its annual meeting in odd years. In 2013, GWIC chose Eugenio Coccia for a second term as GWIC Chair, serving until 2015. The GWIC Chair appoints the Executive Secretary, and Eugenio continued Stan Whitcomb in this position.

### **GWIC Activities in 2012-2013**

GWIC received a report on the status of the proposal in India to build a large gravitational wave detector there in collaboration with the LIGO Laboratory. The project has been included in the five-year plan for Indian science, and is awaiting final agreement between the Indian and US governments.

GWIC convenes the biennial Edoardo Amaldi Conference on Gravitational Waves, sponsored by IUPAP as a "class B" Conference. The Amaldi meeting is considered by many in the gravitational wave community to be their most important international gathering. The members of GWIC serve as the Scientific Organizing Committee for the Amaldi meetings. This year, the tenth Amaldi meeting was held in conjunction with AC2's 20<sup>th</sup> International Conference on General Relativity (GR20) in Warsaw, 7- 13 July 2013. GWIC approved the topics for invited talks at its September 2012 meeting, and approved the plenary and invited speakers via email during the year.

A major decision at the 2013 GWIC meeting was the selection of a venue and local organizing group for the 2015 Amaldi meeting. Four groups presented proposals to host the 2015 Amaldi meeting, in Adelaide (Australia), Budapest (Hungary), Gwangju (Korea), and Minneapolis (USA). All proposals were judged to be excellent. Gwangju was selected, marking the first time that the Amaldi meeting will be held in Korea, and only the second time in Asia.

Since 2006, GWIC has awarded an annual international prize for an outstanding Ph. D. thesis based on research in gravitational waves. The 2012 GWIC Thesis Prize was awarded Paul Fulda from the University of Birmingham, and was presented to him at the Amaldi-10 meeting in Warsaw. There were 11 theses nominated this year, from five different countries. Paul is the first winner from the UK, making it the sixth country represented among the winners in the seven years since the prize was established. GWIC continued its agreement with Springer, to nominate the winner of the GWIC Thesis Prize for publication in the Springer Thesis Series. Springer has accepted Paul's thesis for publication this year.

At its meeting in Warsaw, Eugenio brought up the issue of the Stefano Braccini Thesis Prize. In 2011, an informal group (the Friends of Stefano Braccini) created a separate thesis prize, to honor Stefano, a talented young physicist who had worked with the Virgo project. The assessment of GWIC was that the growth in the field of gravitational waves, as evidenced by the number and quality of the theses nominated for the two prizes, could justify two annual prizes. It was decided, together with the Friends of Stefano Braccini, that the two prizes be announced through a single call for nomination and that the selection of both Prizes be made by a jointly appointed committee. Furthermore, it was proposed that the two prizes be distinguished by emphasizing the impact to the field for the GWIC Thesis prize and by emphasizing creativity and innovation for the Stefano Braccini Prize. This new arrangement will begin with the next call for nominations, for calendar year 2013.



**Membership of GWIC (as of September 2013)**

*Chair:* Eugenio Coccia

*ACIGA:* Peter Veitch

*AURIGA:* Massimo Cerdonio

*Einstein Telescope:* Michele Punturo

*European Pulsar Timing Array (EPTA):* Michael Kramer

*GEO 600:* Karsten Danzmann, Sheila Rowan

*IndIGO:* Bala Iyer

*KAGRA:* Takaaki Kajita, Yoshio Saito

*LIGO, including the LSC:* Gabriela Gonzalez, David Reitze

*LISA:* Neil Cornish, Bernard Schutz, Robin Stebbins, Stefano Vitale

*NANOGrav:* Frederick Jenet

*NAUTILUS:* Eugenio Coccia

*Parkes Pulsar Timing Array (PPTA):* George Hobbs

*Spherical Acoustic Detectors:* Odylio D. Aguiar

*VIRGO:* Francesco Fidecaro, Jean-Yves Vinet

*Theory Community:* Clifford Will

*AC2 Representative:* Beverly Berger

*Executive Secretary:* Stan Whitcomb

# **WORKING GROUP 12**

## **Report from WG 12, August 16, 2013**

(Received from Jon Samseth)

The working group had its first meeting in Tokyo, July 1<sup>st</sup> and 2<sup>nd</sup>. The following mandate was approved

- The working group (WG 12) shall review current energy issues and through International Union of Pure and Applied Physics (IUPAP) make briefs available for the global physics community and policy makers as well as the public at large.
- The group meets once or twice a year to review selected topics taking advantage of local experts where the meeting is held.
- The topics considered should include energy supply, carriers, storage and use. Both advanced and low tech systems shall be looked into.

It was agreed to make briefs on selected issues rather than technical reports. These will be posted on the IUPAP website. It was also agreed to insure quality by having a review system.

The meeting in Tokyo had 4 invited guest talks given by local experts.

- Dr. Toshi Toshi, AIST: Geothermal energy
- Dr. Koichi Kitazawa: Fukushima accident
- Dr. Masakazu Toyoda, IEEJ: Japanese energy situation
- Dr. Koji Yamamoto, Jogmec: Gas hydrates

Based on these talks it was decided to make briefs on geothermal energy and gas hydrates. In order to create a uniform set of briefs, a template has been worked out that will be adopted to each topic. The preparation of the first two briefs has started, including finding reviewers.

The group plans to meet in Norway during spring 2014.

**IUPAC - IUPAC**  
**JOINT WORKING GROUP**

**Brief 2013 status report on the IUPAC/IUPAP  
Joint Working Party (JWP) for the discovery of new elements**

The IUPAC and IUPAP Joint Working Party (the 4<sup>th</sup> JWP) to consider claims for the discovery of new elements was charged with considering claims, submitted electronically by 31 May 2012, for the discovery of the remaining elements in the seventh row of the Periodic Table for which no assignments have yet been made: namely elements with atomic numbers 113, 115, 117 and 118. As of the end of August 2013, all committee members\* have contributed comprehensive critiques of the available documentation, including recent supplementary publications.

As has been the philosophy of the JWP in the past, part of our approach is to be very aware of the influence the discovery recognition process will have on future JWPs.

Both RIKEN (Japan), and Dubna (Russia)/Livermore (US) have claims for discovery of  $Z = 113$  and it can be argued that these may overlap in time. The former, following a “cold fusion” synthesis route to a limited number of events, have possible links through known decay products which, if accepted, would support their claim. The latter, employing “hot fusion”, have many decay chain events, but rather than connecting to known nuclear decays, terminate in non-specific spontaneous fission. Unlike the recent discovery profiles of flerovium ( $Z = 114$ ) and livermorium ( $Z = 116$ ), odd mass number nuclei ( $Z = 113, 115, \text{ and } 117$ ) have many accessible decay pathways, one of several situations which complicates satisfying the discovery criterion of redundancy.

Claims for  $Z = 115$  and  $Z = 117$  arise only from the Dubna-Livermore collaboration(s). The JWP is carefully considering both supportive and disputing points. The acceptability of these claims, since no anchoring to known nuclides occurs, involves cross bombardments (sort of a triangulation of  $Z$  assignment which has been used before to satisfy criteria), and chemical identification of a long-lived end product that undergoes fission. This latter aspect, the possible linking of chemical behavior to that of dubnium ( $Z = 105$ ) has developed into a very influential criterion in our internal debate and requires a convincing critical assessment which is underway.

An initial review of the few events for  $Z = 118$  by the Dubna-Livermore collaboration(s) is seemingly less troublesome, but of course, no recommendation has yet been agreed upon, pending our next exchange of viewpoints.

From experience, the Chair feels that completion of these critiques can be accomplished by the end of the year.

Disclosure: This informal progress statement has been prepared entirely by the Chair of the JWP and has not been reviewed by the membership.

Paul J. Karol, *Chair*  
17 September 2013

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\*\* Due to health and schedule, one member (G. Fortuna, Italy) withdrew from the JWP.

## Appendix

### Members of the JWP

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**A very brief report on  
Astroparticle Physics International Committee (APPIC)**

From Michel Spiro, Chair of APPIC

APPIC is in the process of being formed. It will have about 15 eminent members - scientists from all areas of Astroparticle Physics and all world regions active in this type of research. It will be connected specially to C4 (renaming of this Commission would be welcome), but also to C11, C12 and C19. APPIC will liaise a dialogue with OECD GSF concerning scientific developments in this field, new worthwhile projects, opportunities for international cooperation, and other matters that deserve the attention of the governmental funding agencies. The exact terms of reference of APPIC are still being discussed and worked upon.