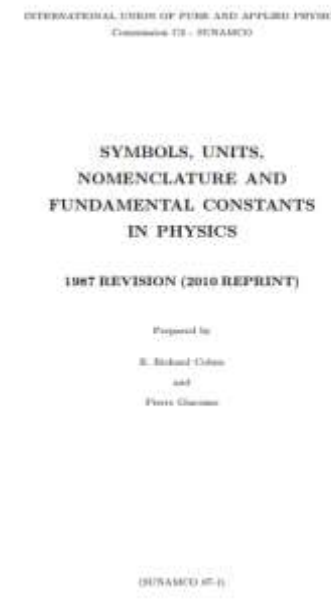
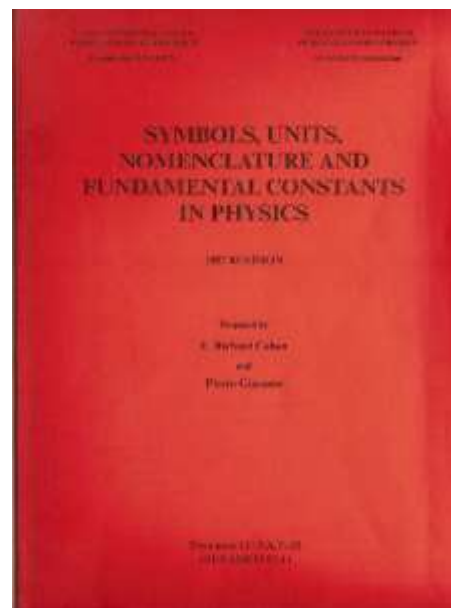


Commissions,
Affiliated
Commissions and
Working Groups of

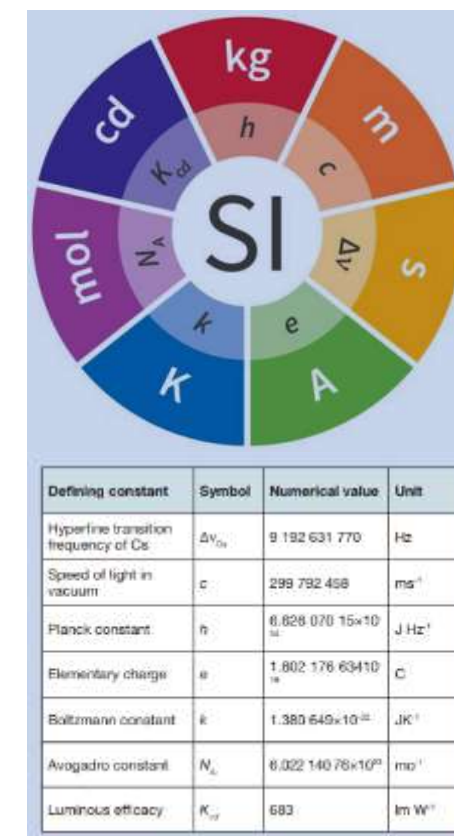


The Commission on Symbols, Units, Nomenclature, Atomic Masses and Fundamental Constants (C2) Established in 1931

The 1987 revision of the SUNAMCO 'Red Book' has for nearly a quarter of a century provided physicists with authoritative guidance on the use of symbols, units and nomenclature. As such, it is cited as a primary reference by the IUPAC '[Green Book](#)' (*Quantities, Units and Symbols in Physical Chemistry*, 3rd edition, E. R. Cohen et al., RSC Publishing, Cambridge, 2007) and the [SI Brochure](#) (*The International System of Units (SI)*, 8th edition, BIPM, S`evres, 2006). This electronic version has been prepared from the original TeX files and reproduces the content of the printed version, although there are some minor differences in formatting and layout. In issuing this version, we recognise that there are areas of physics which have come to prominence over the last two decades which are not covered and also that some material has been superseded. In particular, the values of the fundamental constants presented in section 6 have been superseded by more recent recommended values from the CODATA Task Group on Fundamental Constants. The currently recommended values can be obtained from the [NIST Database](#). SUNAMCO has established a Committee for Revision of the Red Book. Suggestions for material to be included in a revised version can be directed to the SUNAMCO Secretary, [Stephen Lea](#).



Inter-Union Group	
I.U.2	Committee on Data for Science and Technology (CODATA)
I.U.4	Joint Committee for Guides in Metrology (BIPM – JCGM)
I.U.13	IUPAC Commission on Isotopic Abundances and Atomic weights (CIAAW)
I.U.14	IUPAC Interdivisional Committee on Terminology, Nomenclature and Symbols (ICTNS)
I.U.15	Bureau International des Poids et Mesures (BIPM)
I.U.16	International Electrotechnical Commission (IEC/TC25)
I.U.19	IUPAC/IUPAP Joint Working Party on Claims for the Discovery of New Elements (JWP)



The Commission on Statistical Physics (C3) Established in 1945

(<http://iupap.org/commissions/c3-commission-on-statistical-physics/>)

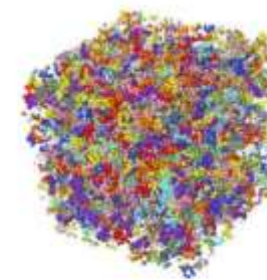
The Commission on Statistical Physics (C3) was established by the International Union of Pure and Applied Physics (IUPAP) in 1945 to promote the exchange of information and views among the members of the international scientific community in the general field of Statistical Physics. The Mandate of the C3 Commission: 1. To promote the exchange of information and views among the members of the international scientific community in the general field of Statistical Physics including: A. statistical and thermodynamic methods concerning the static and dynamic properties of mesoscopic and macroscopic states of matter; B. applications of statistical physics to related fields and non-linear dynamics, turbulence, chemical kinetics, polymers, colloids, liquid crystals, non-crystalline solids, heterogeneous media, neutral networks and computational physics. 2. To recommend for Union sponsorship international conferences which qualify for support under Union regulations. A. To initiate such conferences as their need arises from the evolution of the Commission field. B. To assist in the organization of such conferences when practical. To ensure the compatibility of international conferences in its field and to discourage clashes and incompatibility of dates. 3. To promote the free circulation of scientists; to assist conference organizers in ensuring such free circulation and in resolving potential infringements. 4. To organize where feasible the award of medals or other testimonials of excellence in its field. 5. To publish where feasible newsletters, circulars, occasional books, journals or handbooks in its area. 6. To maintain liaison with other IUPAP Commissions, with the Commissions or Committees of other Unions or of the International Council of Scientific Unions (ICSU) or other scientific organizations, with a view to collaborating and cooperating in sponsoring joint conferences and to participating in joint projects when need arises. A. In particular to maintain close liaison with the General Commissions of IUPAP (SUNAMCO, Physics Education and Development), so as to ensure suitable input from its field into these physicswide activities. 7. To make available to each General Assembly of the Union a summary of activities and progress in its field since the previous Assembly.

Important Meetings and Awards:

The most important meetings that are overseen by the C3 Commission are the IUPAP StatPhys meetings. The Boltzmann Medals and the Young Scientist Prizes are awarded during the IUPAP StatPhys meetings (see <http://iupap.org/commissions/c3-commission-on-statistical-physics/c3-awards/>). Several Topics, in the general area of Statistical Physics are covered during these meetings (see <https://statphys27.df.uba.ar/topics.html>)

Members and Associate Members:

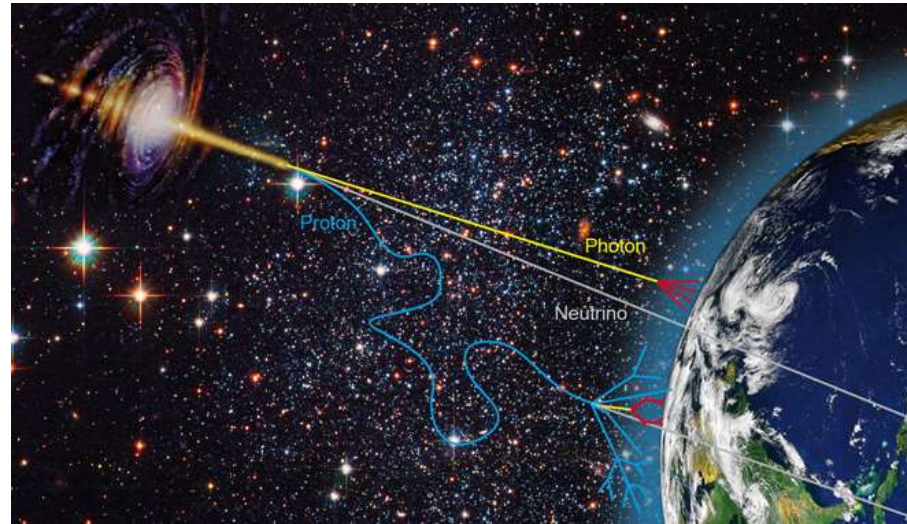
The current list of Members and Associate Members of the C3 Commission is available at <http://iupap.org/commissions/c3-commission-on-statistical-physics/members>



A simulation of a gelatin system at high density for a high concentration of reactant molecules; different colors identify different clusters; regardless of the high density of gelatin chains, a macromolecule is not observed because reactants saturate all active sites of single gelatin chains (image provided by L. de Arcangelis, from T. Abete, et al., THE JOURNAL OF CHEMICAL PHYSICS 129, 134902 (2008)).

The Commission on Astroparticle Physics (C4), previously known as the Commission on Cosmic Rays Established in 1947

The Commission on Astroparticle Physics (C4), previously known as the Commission on Cosmic Rays, was established by the [International Union of Pure and Applied Physics](#) in 1947 to promote the exchange of information and views among the members of the international scientific community in the general field of Cosmic Ray Physics that was broadened into the wider field of Astroparticle Physics, including the nature and characteristics of the electromagnetic, particle and other radiation present in the cosmos; the theory and models concerning the origin of this radiation; non-accelerator high energy physics; the specialized technologies necessary in the field and their application



Violent astrophysical events within and outside the Galaxy are powerful emitters of electromagnetic radiation, charged cosmic rays, neutrinos and gravitational waves. With the current and future generation of experiments expanding their energy and intensity frontiers, the new paradigm of multi-messenger astronomy is now in the realm of reality.

(credits: DESY)

The mandate of the commission includes e.g.

- Initiation and support for International conferences according to the needs of existing and emerging areas of research in the fields covered by the Commission

Among them, the biennial **International Cosmic Ray Conference** has been organized since 1947 (latest edition: ICRC 2019 in Madison, USA: <https://www.icrc2019.org/>). The meeting covers cosmic-ray physics, neutrino physics, γ -ray astronomy, dark matter, solar & heliospheric physics, particle astrophysics, and detector techniques in these fields. Other regularly supported conferences are the biennial **ISVHECRI (International Symposium on Very High Energy Cosmic Ray Interactions)**, **TAUP (Topics in Astroparticle and Underground Physics)**, **Very Large Neutrino Telescope (VLNT)**, **Identification of Dark Matter (IDM)**, and annual **Terra-electron Volt Particle Astrophysics (TeVPA)** series.

- Promotion of free circulation of all scientists; assistance to conference organizers in ensuring such free circulation and in resolving potential infringements

- Organization of the award of medals or other testimonials of excellence in its field.

The following prize winners are selected by the commission and awarded during the ICRC conferences :

- The IUPAP Young Scientist Prizes in Astroparticle Physics in recognition of outstanding contribution of up to a maximum of two young scientists in any area of Astroparticle Physics,

- The Homi Bhabha Medal and Prize established by the IUPAP and the Tata Institute of Fundamental Research (TIFR), Mumbai, India in 2010 to an active scientist who has made distinguished contributions in the field over an extended academic career,

- The [O'Ceallaigh Medal](#) established by the estate of Prof. O'Ceallaigh and the Dublin Institute for Advanced Studies to honour scientists who have made distinguished contributions to Cosmic Ray Physics

**The Commission on Low
Temperature Physics (C5)
Established in 1949**

To promote the exchange of
information and views among
the members of the
international scientific
community in the general field
of Low Temperature Physics.

**The Commission on
Biological Physics (C6)
Established in 1990**

To promote the exchange
of information and views
among the members of the
international scientific
community in the general
field of Biological Physics.

**The Commission on
Semiconductors (C8)
Established in 1957**

To promote the
exchange of
information and views
among the members of
the international
scientific community in
the general field of
Semiconductor
Physics.

The Commission on Magnetism (C9) Established in 1957

The Commission on Magnetism (C9) was established by the International Union of Pure and Applied Physics in 1957 to promote the exchange of information and views among the members of the international scientific community in the general field of Magnetism. This includes phenomena which result in the determination of magnetic interactions at the atomic level, magnetic properties of matter including reduced dimensionality systems (in collaboration with other commissions as appropriate), and technical applications of magnetic materials and generation of magnetic fields.

As the main event, IUPAP sponsors the International Conference on Magnetism (ICM), which is organized every three years, as well as a couple of smaller events.



Néel Medal, showing on one side the figure of Nobel laureate Louis Néel, who discovered antiferromagnetism around 1930, superimposed with a hysteresis cycle and the word magnetism written in the three languages Chinese and Greek, where magnetism developed in ancient time, and English, the language of science today. On the other side, the magnetic structure of magnetite, a ferrimagnetic material is shown. The theory of ferrimagnetism was developed by Néel in 1948.

Two awards are organized by the Commission of Magnetism. The IUPAP Magnetism Award and Néel Medal, established in 1991, is awarded in recognition of outstanding contributions to fundamental and applied magnetism. **It is presented every three years at the International Conference on Magnetism (ICM). The Néel Medal is awarded together with the Magnetism Award, since 2003, sponsored by CNRS and Institut Néel (see Figure). A monetary award for the winner(s) is generously sponsored by Elsevier. The IUPAP Young Scientist Prize in the field of Magnetism is awarded for theoretical or experimental work in fields of fundamental or applied magnetism. First established in 2006, this prize was initially awarded every three years at the International Conference on Magnetism (ICM). Since 2016, this prize has been converted to an annual award. The prize comes with a monetary award from IUPAP.**

The Commission on Structure and Dynamics of Condensed Matter (C10)

Established in 1960

To promote the exchange of information and views among the members of the international scientific community in the general field of Condensed Matter Physics.

The Commission on Particles and Fields (C11) Established in 1957

The aim of particle physics is to study the smallest structures of matter and interactions, both experimentally and theoretically. Surprisingly, these smallest particles influence the large-scale structure of the universe and vice versa.

High energy physics (HEP) has shown that there are many fundamental particles. Among those, the most mysterious is the Higgs boson that was found in 2012 at the Large Hadron Collider (LHC) at CERN. It is responsible for generating the masses of most of the fundamental particles. Other mysteries include differences between matter and anti-matter and the nature of dark matter.



Figure 1. CMS detector at CERN.

Particle physics is now moving to particle accelerators with higher intensity/energy to study the nature of known particles in depth and to search for new ones. At the same time, new underground experiments study rare neutrino interactions and search for dark matter in ultra-clean environments.

HEP experiments bring together hundreds of scientists from around the world to work together. Our mission in C11 is to assure that scientists are able to share their work freely. IUPAP C11 supports international conferences and encourages diversity in the field. C11 also convenes working groups and panels such as the International Committee on Future Accelerators (ICFA) to provide a forum for international coordination.

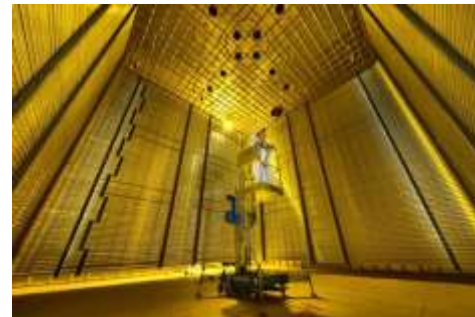


Figure 2. ProtoDune liquid argon detector at CERN.



Figure 3. Belle II experiment in KEK.

The Commission on Nuclear Physics (C12) Established in 1960

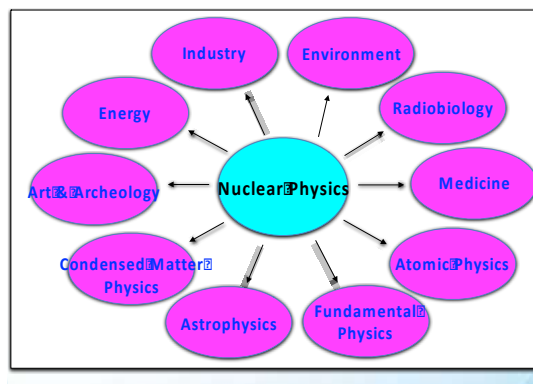
The C12 Commission on Nuclear Physics was established by IUPAP in 1960 to promote the exchange of information and views among the members of the international nuclear physics community. Presently, fourteen physicists from different countries are members of C12. They represent many fields of nuclear physics including:

- nuclear properties and reactions;
- hadronic structure;
- nuclear astrophysics;
- quark matter physics;
- fundamental symmetries;
- nuclear instrumentation and technology;
- applications of nuclear physics.

Thus, nuclear physics spans distance scales from as small as quarks ($\sim 10^{-18}$ m) to as large as the universe ($\sim 10^{26}$ m). It is the key to understanding the stars and the production of the elements of the Periodic Table. A vast array of techniques and instruments, originally developed for nuclear physics, are used in medicine for imaging and treatment. Particle accelerators were invented by nuclear physicists as early as 1930 and quickly became the most important tool of nuclear research. Today there are more than 30000 accelerators in the world, most of them being used in industry and medicine. Nuclear physics thus relates to many fields of science and it encompasses a huge range of applications as shown in the figure above. C12 is an expert resource to IUPAP on these matters and on education and training of the next generation.

C12 & IUPAP Working Groups

C12 are liaised with working groups such as WG9 on International Cooperation in Nuclear Physics and WG14 on Accelerator Science. WG14 maintains a broad view, touching on fields such as material sciences, condensed matter physics, biology, medical isotopes, medical imaging, plasma sciences, to name a few. WG9 was set up in 2003 on the initiative of C12. Among its members are the chairs of the long range planning committees, the chairs of international nuclear physics associations, and representatives of the large nuclear physics research establishments worldwide. Operations within C12 and WG9 form a central part of the global network of nuclear physicists. One endeavour is to create mechanisms and opportunities for enhancing international cooperation and collaboration in nuclear science. Another is to foster cross disciplinary research such as those found in underground laboratories for particle, nuclear, and nuclear-astrophysics, and neutrino science. report was published in the journal Pure and Applied Chemistry in 2018.



Examples of work that C12 undertakes

- Conference Sponsorship: On recommendation from C12 IUPAP supports international conferences within the field of nuclear science.
- Young Scientist Prize in Nuclear Physics: The IUPAP YSP in Nuclear Physics is awarded every third year. Typically around 30 nominations are evaluated each time. The award ceremony of the prize winners takes place at the International Nuclear Physics Conference, INPC, the largest and broadest in scope in nuclear physics.
- Elements of the Periodic Table: When claims for the discovery of a new element of the Periodic Table is being put forward it is the task of IUPAP and IUPAC to validate the claims. To this end a document was produced in 2017: "IUPAC and IUPAP Procedures for Validating Claims for the Discovery of New Elements and Naming those Elements". It was realised that the criteria and rules that are to be followed in the validation procedure also were in need of a revision. A group of scientists, the Joint Working Group, with C12 participation, were appointed by the two unions to undertake that revision.

The Commission on Physics for Development (C13) Established in 1981

Established in 1981, the *IUPAP C13 Commission on Physics for Development* has the mission to promote the exchange of information and views among the members of the international scientific community in the general field of *Physics for Development*. Its major programs include the following:

I. **LAAAMP (Lightsources for Africa, the Americas, Asia and Middle East Project)**

C13 co-launched this flagship project in collaboration with the International Union of Crystallography, with an initial 3-year 300,000-Euro grant from the International Science Council. *LAAAMP* seeks to enhance the utilisation of advanced light sources (both synchrotron and free-electron based) and crystallography in Africa, Mexico, the Caribbean, Southeast Asia and Middle East. See <https://laaamp.iucr.org/>.

II. **Affordable Scientific Equipment**

Due to high costs, there is a serious problem making scientific equipment widely available in many countries. To address this issue, the C13 Commission established the *Group on Affordable Scientific Equipment*.

III. **Physics in Africa**

C13's *Group on Physics in Africa* assists the American Physical Society, U.K. Institute of Physics, European Physical Society, Abdus Salam International Centre for Theoretical Physics, and South African Institute of Physics in their *Physics in Africa Project*, which seeks to enhance physics on the African continent.

IV. **Doctoral Student Recruitment**

C13's *Group on Doctoral Student Recruitment* assists selected universities, mostly in the Trieste, Italy area, in the recruitment of doctoral students.

V. **Conference Sponsorships**

C13 has a long history of providing financial support to physics conferences in developing countries.

VI. **IUPAP Medal for Outstanding Contributions to the Enhancement of Physics in Developing Countries**

C13 awards this medal once every three years.

VII. **Ethics of Scholarly Communication**

C13 formed a group to address critical issues such as plagiarism, which is a problem among researchers in both developing and highly developed countries.

VIII. **IUPAP Centenary Celebrations and International Year of Basic Sciences for Development**

C13 plans to play a major role in this effort, especially providing a voice for developing countries.



Lecture in 2016 ASESMA at University of Ghana. June 2016

The Commission on Physics Education (C14) Established in 1960

It was established by the IUPAP in 1960, to promote the exchange of information and views among the members of the international scientific community in Physics Education. ICPE promotes, organizes, endorses, with the support of IUPAP, international conferences, meetings, workshops and other actions aiming the improvement of the physics worldwide

Some organized/endorsed/supported conferences and events under C14

World Conference on Physics Education (WCPE)

The International Conference on Physics Education (ICPE-GIREP-EPEC)

The International Conference on Physics Education (ICPE-SAIP-WITS) ICPE

Newsletter

The C14 Commission publishes its Newsletter with regularity, primarily in electronic form. The Newsletter is published bimonthly; Issues back to 1995. The last editions available are:

<https://mailchi.mp/d19ceefcf17f/icpe-newsletter-68-january-2019?e=abe1926b4b>

Cooperation/Links of ICPE with other Commissions/Organizations

The ICPE has close cooperation with other IUPAP commissions and other associations and organizations, which promote the improvement of the physics education worldwide, mainly the secretaries of teaching affairs of the physics societies and associations of physics teachers.

Some of the recent partners are listed below.
Women in Physics (WIP) / GIREP / EPEC / IOP / EPS/ ICTP / PHYSWARE / IACPE and others

ICPE Medal

The ICPE medal was instituted to recognize “outstanding contributions to physics teaching of a kind that transcends national boundaries”. The ICPE medal recipient should have fulfilled two criteria: (1) the contributions to physics education should have extended over a considerable number of years; and (2) the contributions should be international in their scope and influence.



Prof. Marco Antonio Moreira (Brazil) – ICPE Medal 2017 among members of the ICPE Commission: left: Eilish Mcloughlin (Ireland), Manjula Sharma (Australia); right: Hideo Nitta – ICPE Chair (2016-2018) - (Japan) and Roberto Nardi (Brazil) - current ICPE Chair (2019-2020)

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.

The Commission on Atomic, Molecular, and Optical Physics (C15) Established in 1966

Since the beginning of the last century, founded on the discovery of the quantum character of light energy to allow the description of the emission spectra of the black body and, the proposed corpuscular behavior of light to explain the photoelectric effect, relevant advances were produced to give a new vision of nature. This new image conducted finally to the formulation of the Quantum Mechanics theory. Different atomic models were proposed trying to combine classical and quantum mechanical concepts. Short time before that the duality character of matter was postulated according to the symmetry of nature, the International Union of Pure and Applied Physics (IUPAP) was established in 1922 in Brussels. The Commission on Atomic, Molecular, and Optical Physics (C15; firstly denominated Commission of Atomic and Molecular Physics and Spectroscopy) was established by IUPAP in 1966 to promote the exchange of information and views among the members of the international scientific community in the general field of Atomic, Molecular and Optical Physics.

The C15 commission organizes two main conferences under the IUPAP support. They are the International Conference on Atomic Physics (ICAP) and the International Conference on Photonic, Electronic and Atomic Collisions (ICPEAC), which are held in an alternating years. The 31st edition of ICPEAC will be held in Deauville, France in 2019 and the 27th edition of ICAP will be developed in Toronto, Canada.

The interest of ICAP covers different quantum systems, including the topology in atomic systems, quantum gases, quantum computation and communication, quantum simulation and quantum annealing, fundamental tests and precision measurements, quantum optics and quantum nanophotonics, intense fields and ultrafast science, Rydberg and artificial atoms and molecules, atomic clocks and quantum metrology, cold molecules and out of equilibrium quantum systems.

The focus of ICPEAC is the presentation and discussion of new research in the field of collisions involving photons, electrons, ions, atoms, molecules, clusters, surfaces, and exotic particles. The latest advances of the domain include ultrafast dynamics at the femto- or attosecond scale, ion-induced radiation damage in particular of biomolecules, atomic spectroscopy and molecular physics of antimatter, free electron lasers, particle acceleration generated by high-power lasers and ultracold collisions.

Every year, the C15 commission recognizes the outstanding research contributions of young scientists through the Young Scientist Prize, which is awarded following a strict selection of nominees from all around the world Other conferences on specific subjects, like the biannual International Conference on the Physics of Highly Charged Ions, are also organized by IUPAP.

The Commission on
Plasma Physics (C16)

Established in 1969

The Commission on Laser Physics and Photonics (C17)

Established in 1975 (as
Quantum Electronics)

Light, an integral part of our life and universe is everywhere. It is indeed at the origin of all life around us. To discover and promote the importance of different roles that light and photonic technologies play in our lives, IUPAP Commission C17 encourages exchange of information and views among the members of the international scientific community in the areas of laser physics, photonics and quantum electronics. The Commission supports worldwide participation of researchers by organizing international conferences, publishing scientific literature and testimonials of excellence (Young Scientist Prize) in these fields. It also arranges public lectures and events to popularise applications of lasers, light-related technologies and physics education.

Starting from 2018, the International Day of Light (IDL) is held on May 16th every year. IDL marks the anniversary of the first successful operation of the laser in 1960 by physicist and engineer, Theodore Maiman. The invention of the laser is an ideal example of how light and photonics-related technologies can revolutionize several fields such as healthcare, communications and entertainment to bring benefits to society. Each year, IDL will be celebrated all over the globe with events focusing on every facet of light and its applications. A special IDL event being organized this year by UNESCO, ***Illuminating Education*** at ICTP, Trieste, Italy, in which C17 members are actively participating is aimed at promoting the use of light science to encourage young people and women, especially in developing countries, to study science and engineering.

UNESCO

International Day of Light
Illuminating Education



16 May 2019

Abdus Salam International Centre for Theoretical Physics
(ICTP), Trieste, Italy

<http://indico.ictp.it/event/8852/smr3375@ictp.it>

www.lightday.org

The theme of lasers and photonics will also be taken up worldwide in various other activities throughout the year that IUPAP C17 will be actively supporting as well as participating. Some of these include: International Conference on Attosecond Science and Technology (ATTO 2019), [Annual International Laser Physics Workshop \(LPHYS'19\)](#), ICO & IUPAP-C17 Topical Meeting on OPTics and Applications to SUsustainableDevelopment (OPTISUD).

More information about the mandate and activities of IUPAP Commission C17 can be found at <http://iupap.org/commissions/c17-laser-physics-and-photonics/>.

The Commission on Mathematical Physics (C18)

Established in 1981

The Commission on Mathematical Physics was established by the International Union of Pure and Applied Physics in 1981 to promote the exchange of information and views among the members of the international scientific community in the general field of mathematics of problems originating in or relevant to physics.

As a field of mathematics and of physics, Mathematical Physics thrives on its diversity of scientific problems and mathematical approaches. Physicists are generally well aware that the development of physics stimulated the creation of new mathematics (for instance, calculus for analytical mechanics and the theory of distributions in Dirac's quantum mechanics) and also that new physical theories came to rely heavily on previously created mathematics (for instance, Riemannian geometry in Relativity and the theory of group representations in the quantum physics of atoms, molecules, condensed matter, and particle physics). Most physicists are less aware, however, of the degree in which this bi-directional process continues to influence both fields today. An overarching goal of C18 is to highlight the importance of this mutually beneficial interaction and to support continuing exchange between mathematics and physics.

C18 shares the goal of making current-day interactions between physics and mathematics visible and more widely known with the International Association of Mathematical Physics (IAMP, founded in 1976). The synergy between C18 and IAMP helps both to be more effective. Therefore, C18 traditionally proposes affiliate membership to the President of IAMP. The tri-annual International Congress of Mathematical Physics (ICMP) is also the main periodic event in mathematical physics and it is routinely supported by IUPAP, most recently the XIXth ICMP, which took place July 23-28, 2018, in Montreal, Canada.

Once a year, IUPAP calls for applications for conference support through its commissions. C18 is helped by the News Bulletin of the IAMP to get the word out and decides which conferences it will present to the Council of Commission Chairs for financial support or endorsement. Examples of conferences supported in the recent past are QMATH and the 2019 Quantum Theory and Symmetry conference.

Every three years, three IUPAP Young Scientist Prize winners are selected by C18 and honored at a prize ceremony at the ICMP. Since the creation of the IUPAP Young Scientist Prize in Mathematical Physics, twelve young mathematical physicists have received the distinction: 2018: Weikuo Chen, Vadim Gorin and Phan Thanh Nam; 2015: Roland Bauerschmidt, Joseph Ben Geloun, and Nicolas Rougerie; 2012: Ivan Corwin, Alessandro Giuliani, and Wojciech de Roeck; 2009: Rupert L. Frank, Benjamin Schlein, and Simone Warzel.

**The Commission on
Astrophysics (C19)
Established in 1984**

The Commission on Computational Physics (C20)

Established in 1996

Computational Physics is that methodological branch of physics where a computer is the basic tool for exploring the laws of nature. The C20 commission was founded by the International Union of Pure and Applied Physics (IUPAP) to promote the exchange of information and views among the members of the international community interested in computational studies of problems originating in or relevant to physics, e.g.: 1.Numerical and symbolic models and algorithms for the simulation of physical systems;^[SEP] 2.Computational control and data processing of experiments;^[SEP] 3.Programming and computational environments;^[SEP] 4.The physical basis of computer machinery.

Why computational physics?

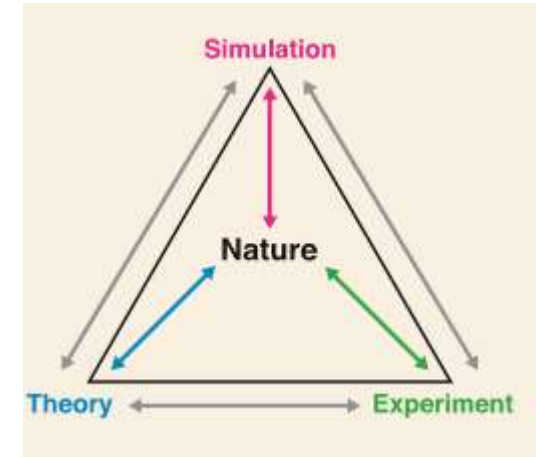
There are many problems which are too complicated for analytical solution, and where for a variety of reasons a real experiment is impossible or undesirable. An advantage of computational simulation is that one can control conditions much more closely than in a real experiment. Well-known examples of this arise in the discoveries of chaos, inelastic scattering of solitons, and period doubling each of which was completely unexpected, and each of which has led to significant advances in theoretical understanding.

A New Area in Computational Physics

Modern computers have developed in a tight symbiosis with computations in physics, and their development has proceeded through mutual interaction. Computational Physics has been rapidly maturing as the third leg of the scientific enterprise alongside Experiment and Theory. The increase in computing power has been so great that it has effectively resulted in a qualitative change in the way computers can be used, and in the emergence of Computational Physics as a distinct methodology. With Exascale computers coming on line in the near future and Quantum Computing looking increasingly likely to become a reality, the future of Computational Physics is certain to unveil new and exciting surprises.

Annual conferences, CCP20xx, are held under the auspices of IUPAP, endorsed by the C20 Commission. The goal of this series is to assemble computational scientists working in physics and related areas to exchange latest developments in computational techniques and their applications.

A Young Scientist Prize in Computational Physics is presented annually to a young scientist within 8 years after their PhD with original work of outstanding scientific quality in Computational Physics.



AC1: INTERNATIONAL COMMISSION FOR OPTICS

The International Commission for Optics, ICO

Established in 1947

The International Commission for Optics was created in 1947. Its objective is to contribute to the progress and diffusion of knowledge in the fields of optics and photonics on an international basis. It is an Affiliated Commission of the International Union of Pure and Applied Physics (IUPAP), and an Affiliated Member of the International Science Council (ISC).

In order to serve and be representative of the optics and photonics community worldwide, ICO maintains contacts with local communities through its Territorial Committees, with International Society Members, and with optical scientists in all countries, welcoming all new contacts. Together with the other societies involved, it contributes to the coordination of international activities in optics and photonics such as in particular scientific meetings. The Commission has three categories of members: Territorial Committee Members (53 members including 12 Associate Members), International Society members (7 members).

The governing body of ICO is its General Assembly, usually held every three years during an ICO Congress that includes an international conference on optics and photonics. Between General Assemblies, a Bureau is responsible for the conduct of the Commission. The Bureau consists of the President, the Past-President, the Secretary General and the Associate Secretary, the Treasurer, and fifteen Vice-Presidents, (eight elected, of whom at least two are from industry, and seven appointed by the International Society Members).



The last ICO General Assembly and its parallel meeting (ICO-24,) took place in Tokyo, Japan from 21–25 August 2017. More than one thousand participants attended from more than 40 countries. ICO-24 was jointly sponsored by the ICO and the Science Council of Japan (SCJ) and co-sponsored by the Japan Society of Applied Physics (JSAP) and the Optical Society of Japan (OSJ). The congress was also technically co-sponsored by many scientific societies including the Chinese Optical Society (COS), the Chinese Society for Optical Engineering (CSOE), the European Optical Society (EOS), the Foundation for Promotion of Electrical, Electronic and Information Engineering, the IEEE Photonics Society, the Institute of Electronics, Information and Communication Engineers (IEICE), the International Society for Optics and Photonics (SPIE), the Laser Society of Japan (LSJ), the Optical Society (OSA), the Optical Society of Korea (OSK), the Physical Society of Japan (JPS), and the Taiwan Photonics Society (TPS). This gives a glimpse of the amplitude of the international activity of ICO. The next ICO General Assembly will be celebrated in Dresden, Germany in September 2020. During the other years, an ICO Topical meeting is held, together with the Bureau meeting. ICO is also very active in sponsoring and supporting Optics and Photonics Conferences and Workshops worldwide, in the Countries represented by its Territorial Committee Members.



The ICO Galileo Galilei Award contributes to one of the essential missions of the International Commission for Optics: it recognizes the promotion of Optics under difficult circumstances. The award was established by the 1993 General Assembly of ICO and has been awarded annually since 1994. ICO and ICTP, the Abdus Salam International Centre for Theoretical Physics, Trieste, agreed in 1999 to establish a joint prize, called the ICO/ICTP Gallieno Denardo Award. It is reserved to young researchers from developing countries (as defined by the United Nations), who conduct their research in a developing country. The award will be given to scientists less than 40 years old (on December 31 of the year for which the award is given), who are active in research in Optics and Photonics, and have contributed to the promotion of research activities in Optics in their own or another developing country.

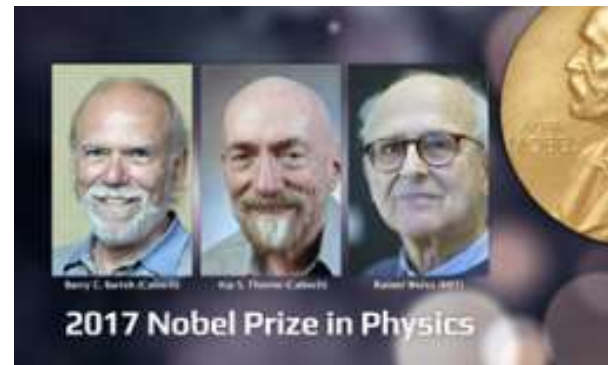
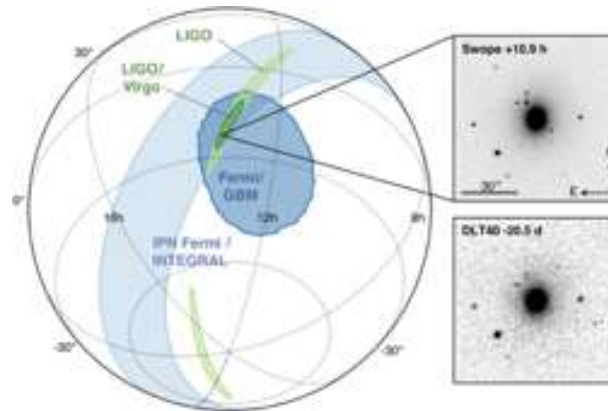
Scientific awards are also an important ICO activity. For instance, in 2005 the International Union of Pure and Applied Physics (IUPAP) created the Young Scientist Prizes for its commissions. The international Commission of Optics (ICO), as an Affiliated Commission of IUPAP, decided in 2008 to adopt the IUPAP Young Scientist Prize in Optics. The IUPAP prize in optics will be awarded annually through ICO to a scientist who has made noteworthy contributions to applied optics and photonics during a maximum of 8 years of research experience after having earned a PhD degree.

Another important award, established in 1982 is the ICO Prize. It is given each year to an individual who has made a noteworthy contribution to optics, published submitted for publication before he or she has reached the age of 40. (Specifically, the Prize winner must not have reached the age of 40 before December 31 of the year for which the Prize is awarded). The character of the work of successive Prize recipients should preferably alternate between predominantly experimental or technological and predominantly theoretical. The "noteworthy" contribution in optics and photonics is measured chiefly by its impact (past or possibly future) on the field of optics generally, opening a subfield or significantly expanding an established subfield in research or technology.

AC2: INTERNATIONAL COMMISSION ON GENERAL RELATIVITY AND GRAVITATION

The **International Society on General Relativity and Gravitation, ISGRG**, is an international learned society and was established in 1971 as the successor to the International Committee on General Relativity and Gravitation

The International Society on General Relativity and Gravitation (ISGRG) joined IUPAP As Affiliated Commission 2 (AC2) in 1975. IUPAP sponsors the triennial conferences of ISGRG (as well as other major meetings in the field) and, since 2013, has supported the annual IUPAP General Relativity and Gravitation Young Scientist Prize. The 22nd International Conference on General Relativity and Gravitation will be held jointly with the 13th Eduardo Amaldi Meeting on Gravitational Waves in Valencia, Spain, in July 2019.



In 1975, the field of Gravitational Physics was very different from today. Most of the practitioners were theorists working on classical and quantum gravity and their applications to relativistic astrophysics. These efforts led to enormous progress in the field, and classical and quantum gravity continue to be major research areas. Prescient experimentalists, led by J. Weber in the 1960s, attempted to detect the gravitational waves predicted by Einstein in 1916. Although early claims of detections were not confirmed, the quest continued and soon became dominated by interferometric detectors. Observational confirmation of Einstein's prediction was obtained by monitoring the orbital decay of the first detected binary pulsar, for which R. Hulse and J. Taylor received the 1993 Nobel Prize. The orbital decay precisely matched the energy loss due to gravitational waves, as predicted by General Relativity. This success helped to motivate the construction of LIGO in the US and Virgo in Italy, in the hope to achieve direct detection of gravitational waves. In September 2015, the first detection of gravitational waves was achieved, with waves originating from the merger of a binary black hole. The never-before detected gravitational waves from a never-before observed source, binary black holes, was a milestone event not just for gravitational physics, but indeed for the entire physics enterprise. In 2017, the Nobel Prize in Physics was awarded to R. Weiss, B. Barish, and K. Thorne for their seminal roles in the success of LIGO. In August 2017, an upgraded Virgo joined LIGO in the search for gravitational waves, and they soon detected a strong signal from the merger of a nearby binary neutron star. Unlike a black-hole merger, which emits only gravitational waves, a neutron-star merger was expected to have an electromagnetic counterpart. This prediction was spectacularly realized with the nearly simultaneous observation of a gamma-ray burst and, thanks to the source localization made possible by the three gravitational wave detectors, the identification of an optical counterpart, a kilonova, in the nearby galaxy NGC 4993. The kilonova was later observed in the X-ray, infrared, ultraviolet, and radio bands.

Image credits: Upper right: Caltech/MIT/LIGO Lab; Lower left: B.P. Abbott et al, "Multi-messenger Observations of a Binary Neutron Star Merger," *Astrophys. J. Lett.* **848**, L12 (2017), <https://doi.org/10.3847/2041-8213/aa91c9>, Fig. 1.

AC3: INTERNATIONAL COMMISSION FOR ACOUSTICS

The International Commission for Acoustics, ICA

Established in 1998. It originally started in 1951 as a subcommittee to the **International Union of Pure and Applied Physics**.

INTERNATIONAL COMMISSION FOR ACOUSTICS

The **International Commission for Acoustics (ICA)** is the primary organization for the national and affiliated organizations that focus on the various aspects of acoustics. Today, ICA comprises 50 National societies and affiliated organizations around the world and promotes international development and collaboration in all fields of acoustics including research, development, education, and standardization.

International Year of Sound 2020



INTERNATIONAL COMMISSION FOR ACOUSTICS

In order to raise the awareness of the community on the importance of sound for our lives, the ICA has decided to organize in 2020, a series of events to comprise the INTERNATIONAL YEAR of SOUND 2020. It will be considered as an outcome of the UNESCO Resolution No. 39 C / 49 "The Importance of Sound in the World Today: Promoting Good Practice" which was an initiative of the Week of Sound (La Semaine du Son), adopted by all UNESCO countries. The International Year of Sound 2020 will include events

- centrally organized by the IYS 2020 liaison committee
- organized by the Week of Sound (La Semaine du Son)
- organized by ICA Member societies and organisations.

All these events will be focused on outreach and education to highlight all the aspects of acoustics. The ICA will maintain a dedicated website to promote and report on all the activities.

23rd International Congress on Acoustics

9 – 13 September 2019

<http://www.ica2019.org>

The German Acoustical Society, DEGA, organizes the **23rd International Congress on Acoustics**, ICA 2019, which will take place in from **9th to 13th of September 2019** in Aachen. ICA 2019 integrates the 4th EAA Euroregio. It comprises internationally high-ranked oral and poster sessions, five plenary lectures, a social program, and several satellite events.

In the opening ceremony, the ICA Early Career award will be presented to **J r mie Voix** from  cole de technologie sup rieure, Montreal.

One of the ICA 2019 sponsors is **IUPAP**

The satellite events include:

- The EAA Spatial Audio Signal Processing Symposium in Paris (6th to 7th September).
- ISRA 2019 – "International Symposium on Room Acoustics" in Amsterdam (15th to 17th September).
- ISMA 2019 – "International Symposium on Musical Acoustics" in Detmold (13th to 17th September).



AC4: INTERNATIONAL COMMISSION ON MEDICAL PHYSICS

The International Organisation on Medical Physics, IOMP

Established in 1953.

IUPAP commissions promote the objectives of the Union within their areas of expertise and provide advice to IUPAP on the activities and needs of the subfields of physics they represent. The International Commission on Medical Physics was established in 2015.

Each year, IUPAP sponsors from 20 to 30 international conferences and awards grants to some of them. The financial support given to these International Conferences is derived from funds collected as membership dues from the members of IUPAP.

Main Medical Physics Scientific Meetings:

- World Congress on Medical Physics and Biomedical Engineering
- International Congress of Medical Physics (ICMP)

IUPAP has sponsored major Medical Physics events including the last World Congress in Prague (2018) and the forthcoming ICMP in Chile (September 8-11, 2019, Santiago).

IOMP invites you to participate in both scientific events ICMP 2019 and World Congress 2021. There will be vast coverage of all fields of Medical Physics including professional, educational and training topics.



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AC4: IUPAP International Commission on Medical Physics

**Medical Physics: Ensuring the
quality of imaging and treatment
procedures while minimizing
radiation risks**

Medical physicists are highly qualified professionals, with an advanced postgraduate university degree followed by specialized clinical training in one or more medical physics disciplines, such as radiation oncology, diagnostic and interventional radiology, nuclear medicine and radiation protection.

The International Organization for Medical Physics (IOMP) represents about 25,000 medical physicists worldwide. The mission of IOMP is to advance medical physics practice by disseminating scientific and technical information, fostering the educational and professional development of medical physicists, and promoting the highest quality medical services for patients.

Main Medical Physics Scientific Meetings:

- World Congress on Medical Physics and Biomedical Engineering
- International Congress of Medical Physics (ICMP)

IOMP collaborates with the International Union of Pure and Applied Physics (IUPAP) on various topics of mutual interest. The IUPAP Young Scientist Awards have been established and funded by the IUPAP and awarded by the IOMP as the IUPAP affiliated International Commission on Medical Physics.



Young Scientist Awards



WG1: INTERNATIONAL COMMITTEE FOR FUTURE ACCELERATORS (ICFA)

Working Group 1 (WG1), the International Committee for Future Accelerators (ICFA)

Established in 1976 in Tbilisi, Georgia to facilitate international collaboration in the construction and use of accelerators for high energy physics.



Its purposes, as stated in 1985, are as follows:

- to promote international collaboration in all phases of the construction and exploitation of very high energy accelerators;
- to organize regularly world-inclusive meetings for the exchange of information on future plans for regional facilities and for the formulation of advice on joint studies and uses;
- to organise workshops for the study of problems related to super high-energy accelerator complexes and their international exploitation and to foster research and development of necessary technology.



WG2: COMMUNICATION IN PHYSICS

Working Group 2 (WG2),
Communication in
Physics,

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It has been reconstituted
to consider the problems
that are emerging in
electron publishing, and
particularly considers
internet availability/
reliability, linking
between societies and
publishers, availability of
electronic
communication in
isolated areas, archiving,
peer review, and
intellectual property.

WG5: WOMEN IN PHYSICS

Working Group 5 (WG5), [Women in Physics](#) (WiP)

Established in 1999 as a resolution of the Atlanta, Georgia, USA General Assembly to survey the present situation and report to the Council and the Liaison Committees, and to suggest means to improve the situation for women in physics.

The aims of Working Group 5 (WG5), Women in Physics were to survey the situation for women in physics in IUPAP member countries around the world, to analyse and report the data collected and to provide suggestions on how to improve the situation. WG5 was created in 1999 and now works well beyond these original aims.

The International Conference on Women in Physics (ICWIP) is held every three years, bringing together men and women from around the world to report on the situation of women in physics in their country, to share good practice, to suggest and implement means of improvement and to network. Over 92 different countries and over 1300 delegates have attended the ICWIPs and many new national bodies on women in physics have been created and regional meetings have taken place. The Conference Proceedings, available online, are a source of statistics and good practice across the world. The seventh ICWIP is being held in Melbourne Australia in 2020.

Every year WG5 awards travel grants to women from developing countries to enable them to attend conferences that will support them in their career. Over 16 years, nearly 500 grants have been awarded.

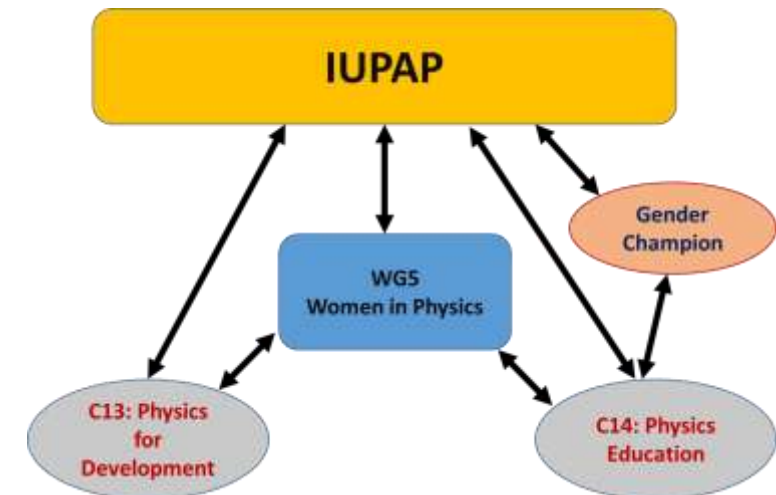
Global surveys of female physicists were carried out in 2002 and 2006, with men being included in the third survey in 2009-10. The latest survey, collected in 2018, was carried out with ten other International Science Council (ISC) Unions and members as part of a project called A Global Approach to the Gender Gap in Mathematical, Computing and Natural Sciences: How to Measure It, How to Reduce It (the "Gender Gap project"). As well as highlighting long term changes in physics the results will allow comparison with other science based subjects. The project has fostered strong links between the gender groups within the participating Unions.

WG5 has worked with IUPAP and in particular the Gender Champion, on policies such as their Harassment Policy for IUPAP sponsored conference and the Waterloo Charter, a declaration of principles and list of good practices for a more inclusive practice of physics that will be presented to the General Assembly in 2020.

The recently created International Day of Women in Physics (IDWIP) on February 11th aims to celebrate women in physics of the past, to support women in physics now, to inspire future women in physics.



Conference delegates ICWIP2017 Birmingham UK with special guest speaker Malala Yousafzai



The recently created International Day of Women in Physics (IDWIP) on February 11th aims to celebrate women in physics of the past, to support women in physics now, to inspire future women in physics.

IUPAP Working Group 7

International Committee on Ultrahigh Intensity Lasers (ICUIL) - The International Committee on Ultrahigh Intensity Lasers (www.icuil.org) was formed in 2004 as Working Group 7 of the International Union of Pure and Applied Physics.

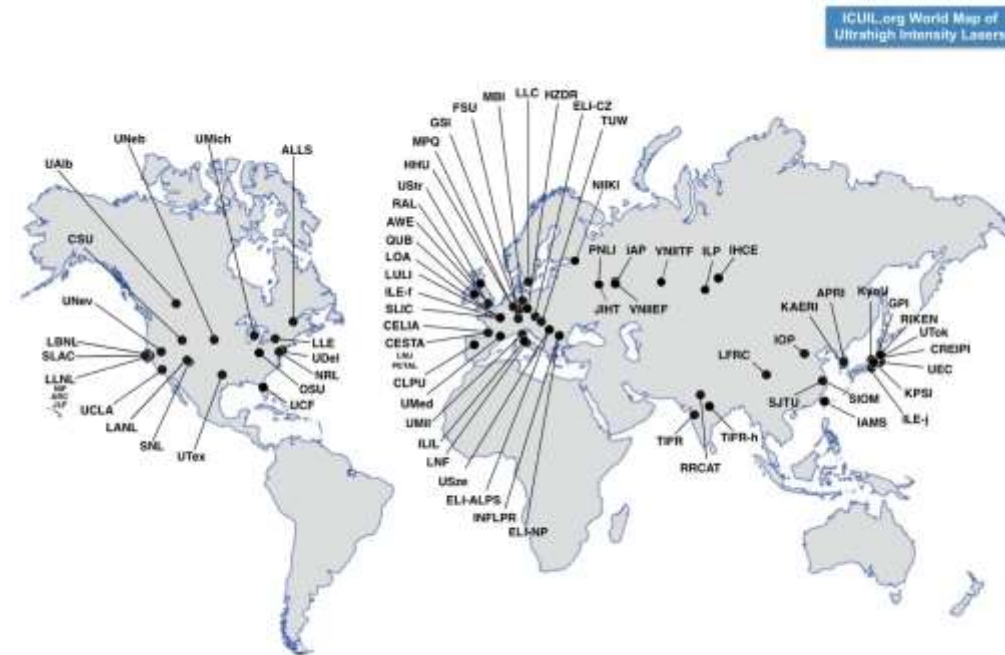
ICUIL aims

- 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 ultrahigh 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.
- To promote unity and coherence in the field by convening conferences and workshops dedicated to ultrahigh intensity lasers and their applications.
- To accelerate progress in the field by sharing information, exploring opportunities for joint procurement, and exchanging equipment, ideas and personnel among laser laboratories world-wide.
- To attract students to high-field science by promoting their education and training, their interactions with prominent scientists, and access to the latest equipment, results and techniques.
- To strengthen and exploit synergy with other relevant fields and techniques, notably accelerator-based free electron lasers.

The ICUIL community represented in the ICUIL.org world map below today corresponds to more than \$4B of global science activities

At the core of each of these facilities is a high intensity laser system based on chirped pulse amplification. The 2018 Nobel prize in Physics was awarded in part to Prof. Gerard Mourou (ICUIL's 1st chairman) and Prof. Donna Strickland for their invention of chirped pulse amplification.

Every two years, ICUIL sponsors the International Conference on Ultrahigh Intensity Lasers. This highly successful conference series will next be held in 2020 in Jeju, South Korea. More information about ICUIL and its activities may be found on the organizations web page (www.icuil.org)

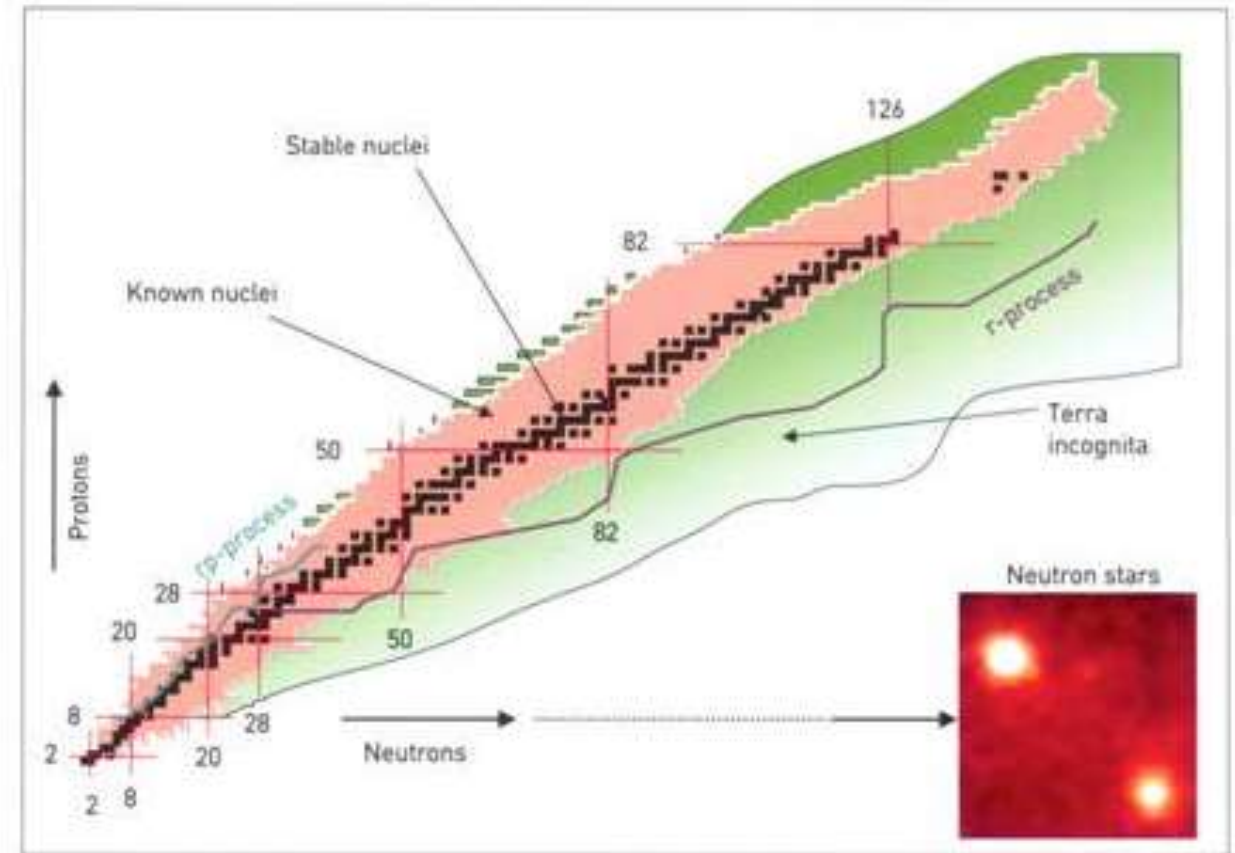


WG9: INTERNATIONAL COOPERATION IN NUCLEAR PHYSICS (ICNP)

Established in 2003 with a mandate to look at the key issues in Nuclear Physics.”

Aims of the Working Group

- to provide a description of the landscape of key issues in Nuclear Physics research for the next 10 to 20 years;
- to produce (maintain) a compendium of facilities existing or under development worldwide;
- to establish a mapping of these facilities onto the scientific questions identified above;
- to identify missing components that would have to be developed to provide an optimized, comprehensive network of international facilities;
- to explore mechanisms and opportunities for enhancing international collaboration in nuclear science;
- to identify R/D projects that could benefit from international joint effort;
- to serve as a source of expert advice for governmental or inter-governmental organizations in connection with efforts to coordinate and promote nuclear science at the international level;
- to serve as a forum for the discussion of future directions of nuclear science in the broadest sense;
- to document the cross-disciplinary impact of Nuclear Physics and of nuclear facilities and to identify mechanisms for expanding (fostering) cross-disciplinary research.



The Nuclear Landscape

WG10: ASTROPARTICLE PHYSICS INTERNATIONAL COMMITTEE (APPIC) Working Group 10 (WG10)

**Established in 2011 at the London,
England General Assembly to review the
scientific status of the field of
Astroparticle Physics.**

The Mandate of the Working Group

- review on a regular basis the scientific status of the field of Astroparticle Physics;
- engage in a continuous dialogue with “The Astroparticle Physics International Forum (APIF)” of the Global Science Forum (GSF)² and to give scientific advice to APIF, whose members are appointed by funding agencies;
- comment on and liaise with similar national and international organs on assessment and road-mapping activities, as the need may arise, such as for promoting the global coherence of plans, priorities and projects, in Astroparticle Physics.



WG11: GRAVITATIONAL WAVE INTERNATIONAL COMMITTEE (GWIC)
Working Group 11 (WG11), the Gravitational Wave International Committee (GWIC) was created by the International Union of Pure and Applied Physics in 1997 to facilitate international collaboration and cooperation in the construction, operation and use of the major gravitational wave detection facilities world wide. GWIC is associated with IUPAP C19, AC2 and WG10.

Aims of the Working Group

- promote international cooperation in all phases of construction and scientific exploitation of gravitational-wave detectors;
- coordinate and support long-range planning for new instrument proposals, or proposals for instrument upgrades;
- promote the development of gravitational-wave detection as an astronomical tool, exploiting especially the potential for multi-messenger astrophysics;
- organize regular, world-inclusive meetings and workshops for the study of problems related to the development and exploitation of new or enhanced gravitational-wave detectors, and foster research and development of new technology;
- represent the gravitational-wave detection community internationally, acting as its advocate;
- provide a forum for project leaders to regularly meet, discuss, and jointly plan the operations and direction of their detectors and experimental gravitational-wave physics generally.

WG12: ENERGY

Working Group 12 (WG12), Energy

Established in 2012 at the Executive Council meeting in Rio de Janeiro, Brazil to review current energy issues.

Aims of the Working Group

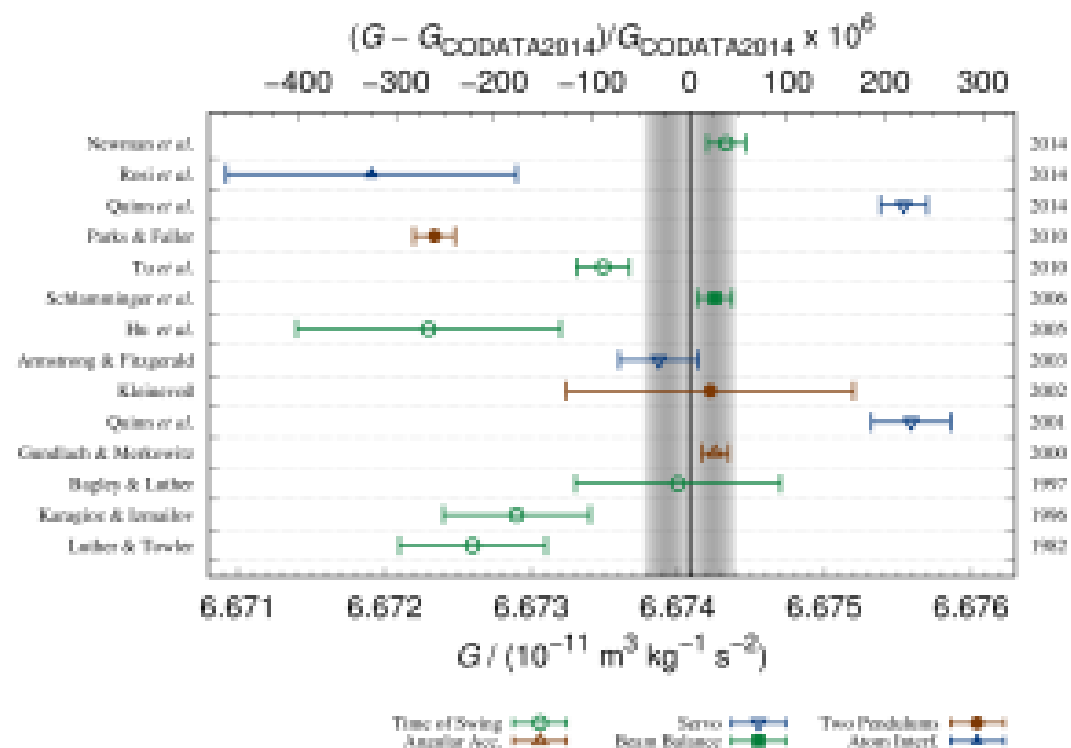
- the Energy Working Group 12 shall review current energy issues and through International Union of Pure and Applied Physics (IUPAP) make briefs available for the global physics community and policy makers as well as the public at large;
- the group meets once or twice a year to review selected topics 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.

WG13: NEWTONIAN CONSTANT OF GRAVITATION

Established in 2016 for the primary purpose of supporting experimental efforts to measure the Newtonian constant of gravitation, G .

To achieve this goal the working group will:

- Provide a group of individuals who are willing to work with experimenters on various technical questions and issues,
- Convene regular meetings on the subject of G measurements,
- Serve as a forum to discuss future experiments, proposals and new ideas,
- Consider and discuss possible mechanisms that might explain the existing discrepancies between at least some of today's measurements and
- Evaluate possible strategies for performing G experiments blindly to avoid unconscious bias



WG14: ACCELERATOR SCIENCE

Established in 2015

WG 14 has been created to promote the exchange of information and views among the members of the international scientific community in the field of Accelerator Science including, but not limited to, the following:

- the theory and experiments concerned with the nature and properties of particle accelerators and beam physics
- the improvement of international communication in Accelerator Science through the sponsorship of professional meetings
- the future of accelerator facilities for various fields that benefit science and society
- the industrial, medical, energy production and environmental applications of relevant accelerator technologies

WG15: SOFT MATTER

Established at the 29th
General Assembly

The 29th General Assembly resolved to establish the Working Group on Soft Matter Physics, WG15, with the mandate:

- To organize/assist in organization of an International Conference “Soft Matter Around the World” which rotates every 3 years to each geographic region (Europe-Africa, the Americas, and Asia-Pacific).
- To coordinate soft-matter-related regional, national & local conferences, meetings & workshops
- To coordinate soft matter education, such as summer/winter schools and short courses and help organize them if a need appears
- To promote soft matter research through information exchange, publicity, prizes, publications, etc.
- To strengthen the connections between academic and industrial soft matter research and development through outreach events, short courses, etc.

<http://iupap.org/working-groups/wg15-soft-matter/>

Soft Matter Around the World in 3 Years

