C14 - Physics Education Commission of the International Union of Pure and Applied Physics

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What is the IUPAP and why we talk about it today?

- **The International Union of Pure and Applied Physics (IUPAP)** is a unique international physics organization, the only one that is founded and run solely by the physics community.

- The IUPAP connects physicists from all fields and all continents.

- Its members are nominated by physics communities in member countries representing different regions around the world.

- It depends on volunteers.

- Canada is one of the founding members of IUPAP.

- IUPAP celebrates its centennial anniversary in 2022-2023.

- The Commissions of IUPAP (including C14-Physics Education) will promote the educational and scientific activities of IUPAP around the world.

IUPAP International Union of Pure and Applied Physics

The aims of the Union are:

- **to stimulate and promote international cooperation in physics;**
- **to sponsor suitable international meetings and to assist organizing committees;**
- **to foster the preparation and the publication of abstracts of papers and tables of physical constants;**
- **to promote international agreements on other use of symbols, units, nomenclature and standards;**
- **to foster free circulation of scientists;**
- **to encourage research and education**

International Union of Pure and Applied Physics

Further IUPAP principles:

- **Foster openness and inclusiveness in physics;**
- **Ensure integrity and credibility;**
- **Promote physics as a building block of innovation and multidisciplinary research;**
- **Promote physics as an essential tool for development and for sustainability;**

Strategic Plan

Fulfilling the commitments that were made upon its creation and expanding on them, the new strategic plan of IUPAP and its proposed actions aspire to achieve the following goals:

- **Assist in the worldwide development of physics and promote physics as an essential tool for development and sustainability;**

- **Engage in the strengthening and improvement of physics education, particularly in developing countries;**

- **Increase diversity and inclusion in physics, enhancing the participation and recognition of women and of people from underrepresented groups;**

1922

The beginnings...

In 1919 was formed the International Research Council "largely through the representatives of the National Academy of Sciences, Washington, and of the Royal Society, London, to co-ordinate international efforts in the different branches of sciences, under whose aegis international associations or unions in different branches of science could be formed".

In accordance with this principle, the 1922 General Assembly of the IRC convened at Brussels and a number of physicists present decided that the formation of a Physics Union was imperative.

Thirteen countries immediately announced their adherence to the new Union.

An "Executive" or steering committee of ten distinguished physicists undertook to prepare rules, regulations and activities of the organization.

The I.U.P.A.P. was launched.

For the history of IUPAP's first 70 years, see the IUPAP website

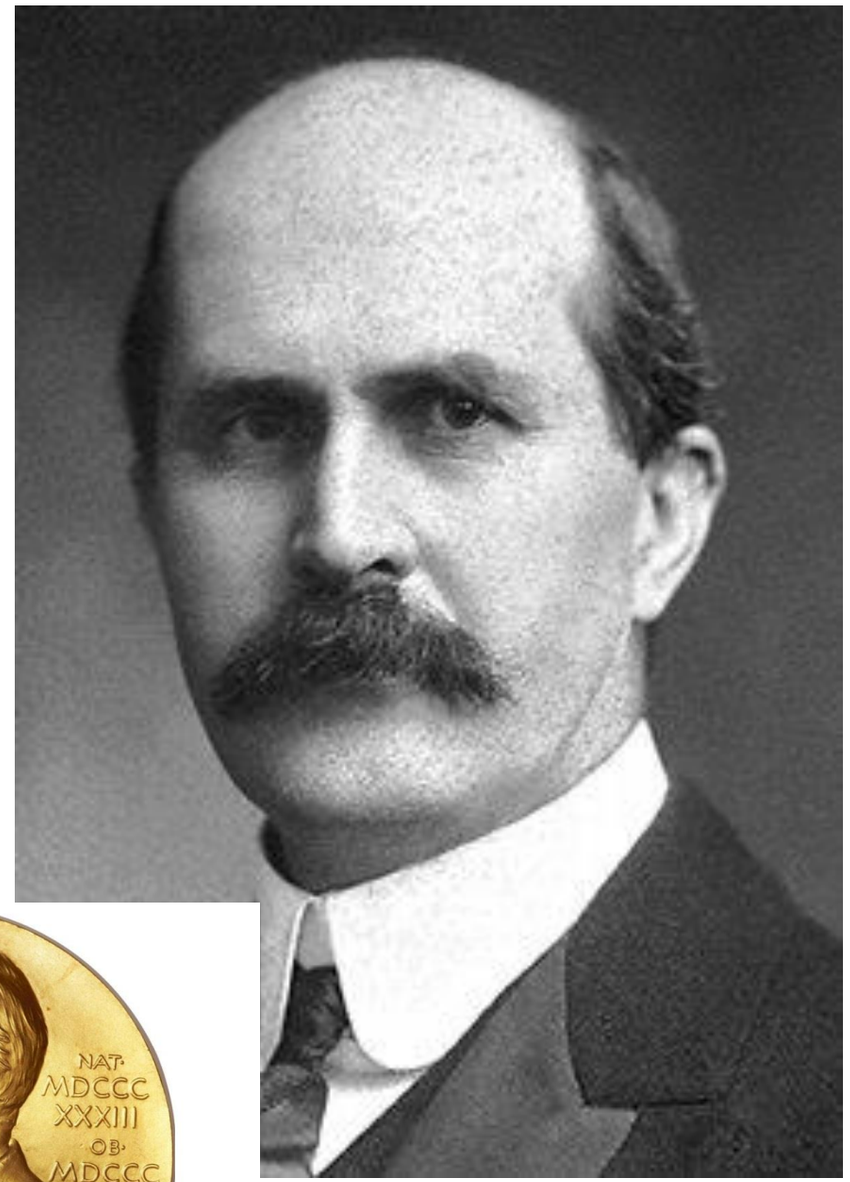
http://iupap.org/about-us/the-history-of-iupap-1922-1992/

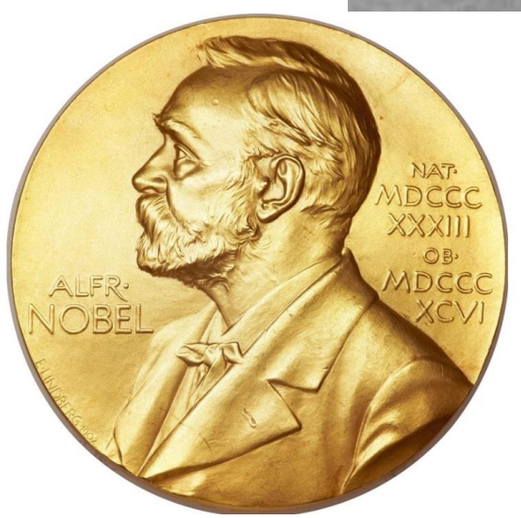
IUPAP was established in 1922

First President:

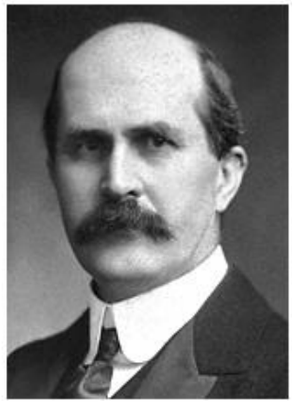
Sir William Bragg

(1922-1931)





1922



William Bragg
First IUPAP President

The Thirteen

1. Belgium
2. Canada
3. Denmark
4. France
5. Holland
6. Japan
7. Norway
8. Poland
9. Spain
10. Switzerland
11. United Kingdom
12. United States of America
13. Union of South Africa

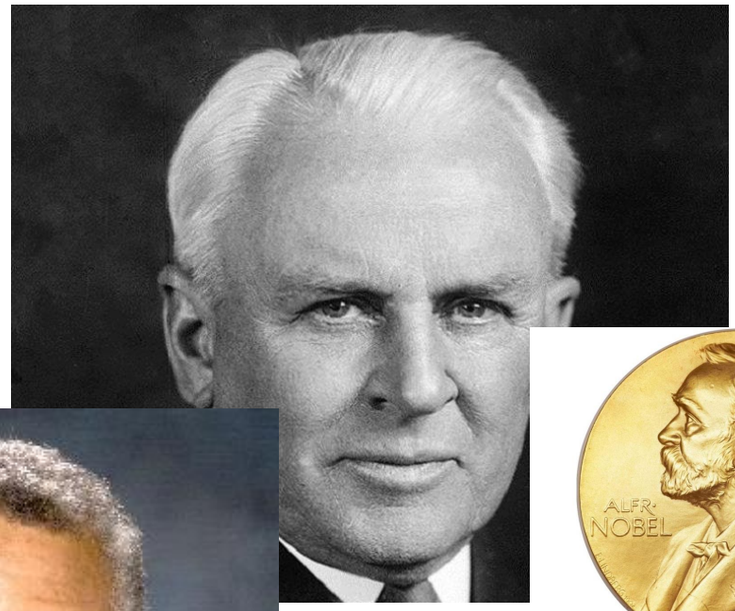
The Ten

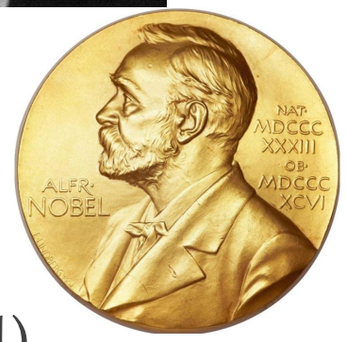
W. Bragg, president
M. Brillouin
O.M. Corbino
M. Knudsen
M. Leblanc
R.A. Millikan
H. Nagaoka
E. Van Aubel, vice-présidents
H. Abraham, secretary

Past Leadership

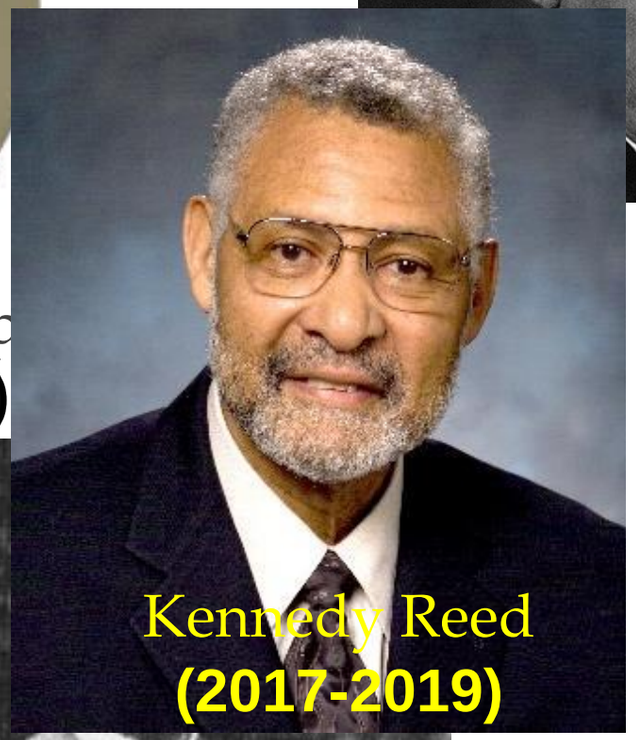
Edoardo Amaldi
(1957-1960)

Cecilia Jarlskp
(2011-2014)

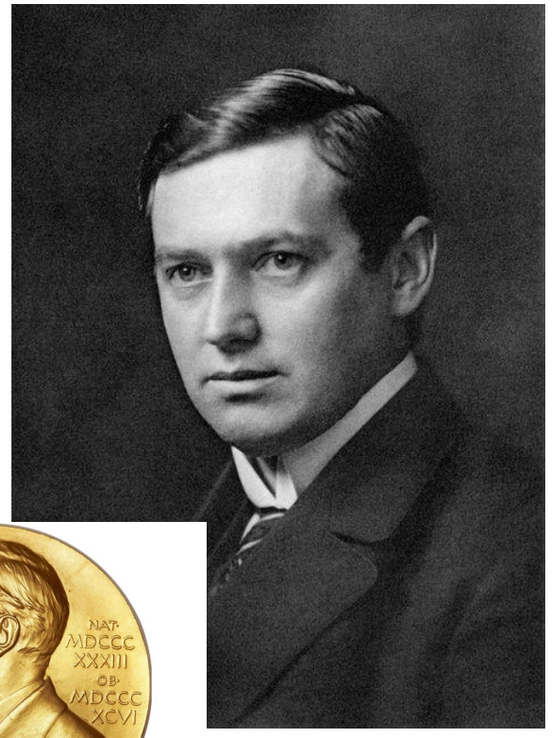




(1931-1934)



Kennedy Reed
(2017-2019)



Neville Francis Mott
(1951-1957))

Hans Kramers
(1947-1951)

Manne Siegbahn
(1934-1947)

Current Members (61)

Algeria
Argentina
Australia
Austria
Belgium
Brazil
Bulgaria
Canada
Chile
China: Beijing
China: Taipei
Colombia
Costa Rica
Croatia
Cuba
Cyprus
Czech Republic
Denmark
Egypt
Estonia
Ethiopia
Finland
France
Germany
Ghana
Greece
Hungary
India
Iran
Ireland
Israel
Italy
Japan
Jordan
Korea
Latvia
Lithuania
Mexico
Netherlands
New Zealand
Norway
Pakistan
Peru
Philippines
Poland
Portugal
Romania
Russia
Saudi Arabia
Senegal
Singapore
Slovak Republic
Slovenia
South Africa
Spain
Sweden
Switzerland
Tunisia
UK
Uruguay
USA

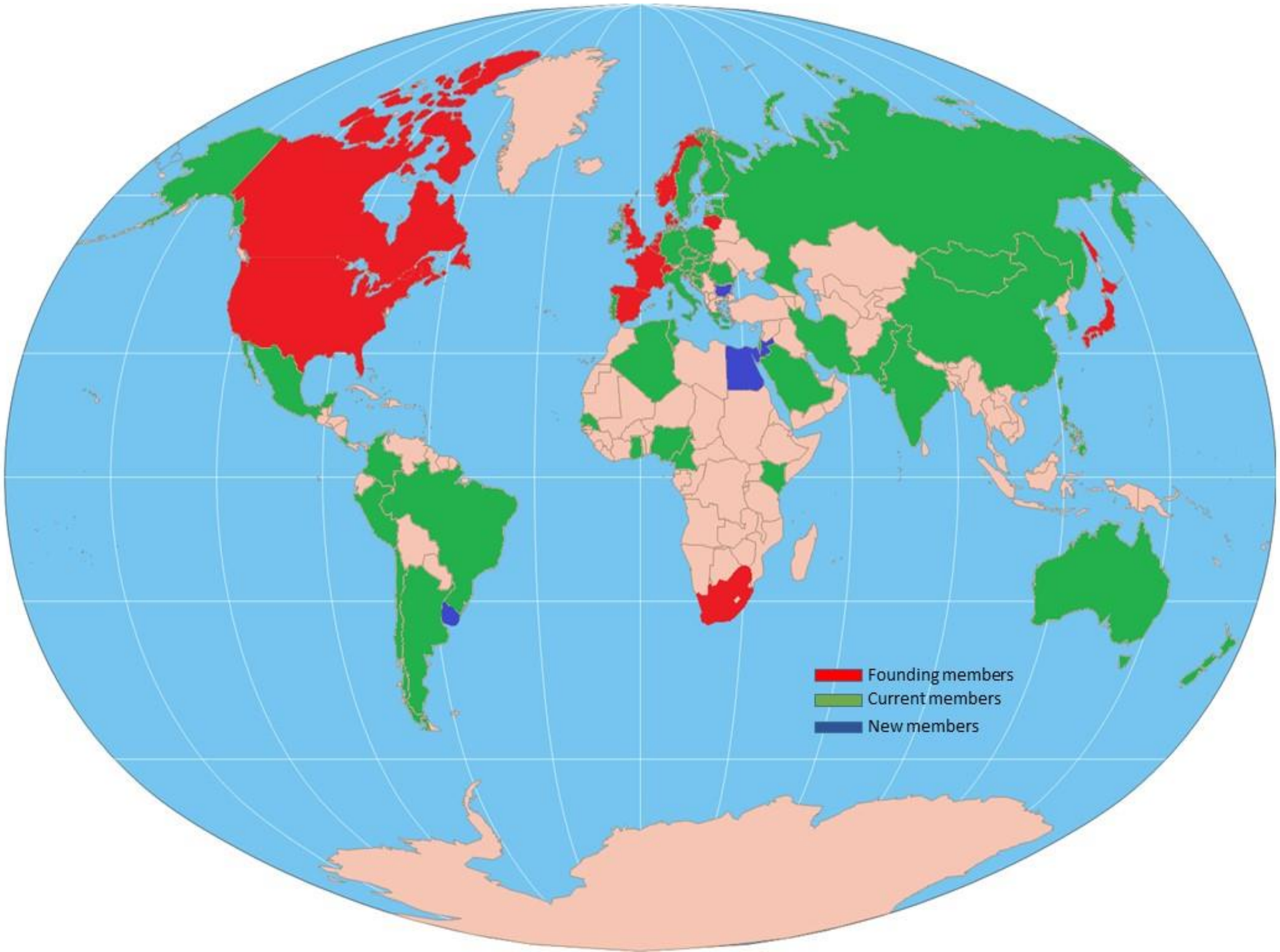
Four regional Physics Societies are observers: African, American, Asian Pacific and European

Corporate Associate Members are being considered

IUPAP is looking into attracting new members (countries)

Ukraine just joined!

IUPAP Members' Map



Governance

- **Governed according to the New Statutes and Bylaws of the International Union of Pure and Applied Physics (adopted by the General Assembly, 2021)**

- **The IUPAP will get the legal status as an Association under Swiss Law, located in Geneva with the Administrative Office in Trieste**

Bylaws: https://iupap.org/documents/statutes-bylaws/

- **Vision, mission, strategic plan are also posted on the website**

Governance:
The General Assembly

The General Assembly (GA) of all membres is the highest governing body of the Union.

The GA

- **Creates and amends the statutes (requires a two-thirds majority of those present).**
- **Sets and amends the procedural bylaws (requires a three-fifths majority of those present).**
- **Elects the Executive Council that oversees Union activities between General Assemblies.**
- **Elects members of its Commissions.**
- General Assemblies are every 3 years in person, every year virtually in between

The Structure

- **Commissions**
- **Affiliated Commissions**
- **Working Groups**

Commissions

- **The first scientific commission, on Units, was established in 1931 at the third General Assembly.**
- **Currently there are 18 Commissions.**
- **The commissions organize the major International conferences in their field; and award Young Scientist Prizes**

- **Symbols and Units (C2)**
- **Statistical Mechanics (C3)**
- **Astroparticle Physics (C4)**
- **Low Temperature Physics (C5)**
- **Biological Physics (C6)**
- **Semiconductors (C8)**
- **Magnetism (C9)**
- **Condensed Matter (C10)**
- **Particles and Fields (C11)**
- **Nuclear Physics (C12)**
- **Physics for Development (C13)**
- **Physics Education (C14)**
- **Atomic Molecular and Optical Physics (C15)**
- **Plasma Physics (C16)**
- **Laser Physics and Photonics (C17)**
- **Mathematical Physics (C18)**
- **Astrophysics (C19)**
- **Computational Physics (C20)**

(There are no commissions 2 and 7)

Affiliated Commissions

- **International committees or organizations of physicists, with their own administrative structure, who wish to join IUPAP commissions**

- **Currently there are 4 +2 affiliated commissions**

- **Participate in IUPAP activities, endorse IUPAP principles**

- **International Commission for Optics (AC1)**
- **International Commission on General Relativity and Gravitation (AC2)**
- **International Commission on Acoustics (AC3)**
- **International Commission on Medical Physics (AC4)**
- **International Association of Physics Students (AC5 New)**
- **Affiliated Commission on the History and Philosophy of Physics (AC6 New)**

Working Groups

WG1: International Committee for Future Accelerators (ICFA)
WG2: Communication in Physics
WG5: Women in Physics
WG7: International Committee on Ultrahigh Intensity Lasers (ICUIL)
WG9: International Cooperation in Nuclear Physics (ICNP)
WG10: Astroparticle Physics International Committee (ApPIC)
WG11: Gravitational Wave International Committee (GWIC)
WG12: Energy
WG13: Newtonian Constant on Gravitation
WG14: Accelerator Science
WG15: Soft Matter
WG16: Physics and Industry
WG17: Centenary – temporary, time-sensitive
WG18: EthicsWG19: Quantum Science and Technology

Some working groups have had close links with working groups of the OECD Global Science Forum

The Working Group on Women in Physics

Conferences

IUPAP sponsors and endorses ~**50 conferences per year**:

- **Very large, medium size, specialized**
- everywhere with a special **attention to developing countries**

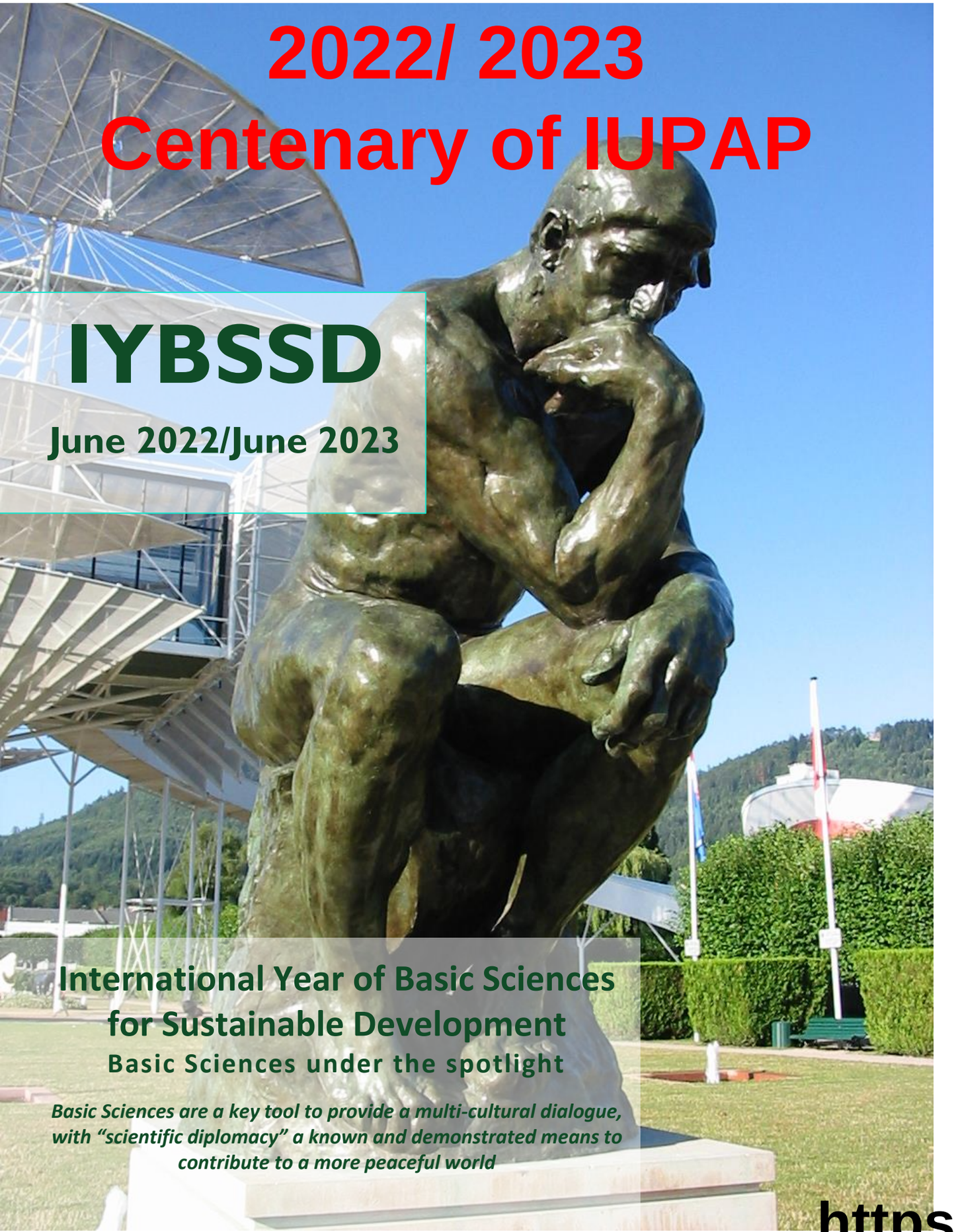
Requirements are:

- **scientific interest**
- **worldwide attendance with no a priori restriction or difficulty to attend**
- **inclusiveness and diversity**

Early Career Scientific Prize Awards

- The Early Career Scientist Prize is granted by IUPAP on the recommendation of a Commission or an Affiliated Commission.
- The award consists of a certificate, medal and a monetary award.
- A presentation also takes place at an international conference sponsored through the commission.
- 192 prizes awarded between 2006 and 2018!

2022/ 2023
Centenary of IUPAP



IYBSSD

June 2022/June 2023

International Year of Basic Sciences for Sustainable Development

Basic Sciences under the spotlight

Basic Sciences are a key tool to provide a multi-cultural dialogue, with "scientific diplomacy" a known and demonstrated means to contribute to a more peaceful world

IAU International Astronomical Union

International Mathematical Union CDC

International Science Council

IUBS

IUPAC International Union of Pure and Applied Chemistry

CERN

The Abdus Salam International Centre for Theoretical Physics

EPS

JOINT INSTITUTE FOR NUCLEAR RESEARCH

IRD Institut de Recherche pour le Développement FRANCE

IUPAP

Leading Union

https://www.iybssd2022.org/

Celebrations For The IUPAP Centennial

- **IUPAP will celebrate its Centennial in 2022/2023. Several initiatives are being planned.**

- **They include a Centennial Symposium, a photo contest and satellite events around the world.**

- **Many of these activities will be combined with those of the Year of Basics Science for Sustainable Development (YBSSD), given that the IUPAP's work on promoting physics and science for development will be a major part of its centenary celebrations.**

Celebrations For The IUPAP Centennial (continued)

- **IUPAP is arranging for dedicated talks in large IUPAP-sponsored physics conferences to publicize all these activities.**

- **We encourage the various commissions and national physics communities to organize satellite events worldwide.**

- **We suggest to make the Conferences in 2022 and 2023 part of the Celebration of the IUPAP Centenary and IYBSSD**

- **Participants are welcome to use slides from IUPAP presentations, centenary, IYBSSD to show them in events and conferences all along 2022 and 2023**

Celebrations For The IUPAP Centennial (Continued)

- **An important effort has also started to digitize IUPAP's institutional archival documents of the Union, which are currently spread in various archives.**

- **The digitized documents will be made available for public dissemination and historical research.**

- **They will constitute the primary source of information for a scholarly process, which will be concluded by a two-day academic workshop on the history of IUPAP in the last hundred years and the publication of a volume.**

Centennial Symposium Plans

Program based on the following ideas:

- Three 30' segments (maybe four) on the IUPAP history
- Two testimonials from the past
- A virtual connection to a very large (ICHEP 2022, in Bologna, ~1000 people) C11 IUPAP type A conference on day one
- Five 1h panels on IUPAP mission statements
  1. Women and underrepresented groups
  2. Science advising policy
  3. Early career
  4. Physics for development
  5. Education
- Three 1h regional panels addressing achievements in the region and expectations from IUPAP (What can IUPAP do for the region?)
  1. Latin America
  2. Asia & Pacific
  3. Africa & Middle East
- Four prestigious keynote speakers
- Three brief (20') early-career keynote speakers (award winners)
- Two thematic presentations (mini 30' panels):
  1. Why it is important to be a member
  2. Focus on physicists working in industry

C14-Physics Education Commission of IUPAP

The International Commission on Physics Education (ICPE) mission:

To promote the exchange of information and views among the members of the international scientific community in the general field of Physics Education including:

- **The collection, evaluation, coordination and distribution of information concerning education in the physical sciences at all levels;**

- **Information relation to the assessment of standards of physics teaching and learning;**

- **Suggesting ways in which the facilities for the study of physics at all levels) might be improved, stimulating experiments at all levels, and giving help to physics teachers in all countries in incorporating current knowledge of physics, physics pedagogy, and the results of research in physics education into their courses and curricula.**

C14-Physics Education Commission of IUPAP Activities

- **The complete mission statement can be found at https://iupap.org/who-we-are/internal-organization/commissions/c14-physics-education/#mission-mandate.**

- **One of the core activities of the Commission is the organization of the International Conference on Physics Education (ICPE), often in partnerships with other international or regional physics/science education societies.**

- **The Commission awards Physics Education Medal every year**

- **The Commission produces the ICPE Newsletter.**

- **As IUPAP celebrates its centennial anniversary in 2022-2023 with Canada being one of the founding members of IUPAP, the Commissions of IUPAP (including C14) will promote the educational and scientific activities of IUPAP around the world.**

C14 Commission

- **Recommends for Union sponsorship of the international conferences which qualify for support under Union regulations.**

- **Initiates such conferences as their need arises from the evolution of the Commission field.**

- **Assists in the organization of such conferences when practical.**

- **Ensures the compatibility of international conferences in its field and to discourage clashes and incompatibility of dates.**

- **Promotes the free circulation of scientists; assists conference organizers in ensuring such free circulation and in resolving potential infringements.**

C14 Mission (continued)

- organizes where feasible the award of medals or other testimonials of excellence in its field.

- publishes where feasible newsletters, circulars, occasional books, journals or handbooks in its area.

- maintains 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.

- Prepares to each General Assembly of the Union a summary of activities and progress in its field since the previous Assembly.

C14 Conferences

- **3rd WCPE** Vietnam, 13-17 December 2021
- **2019**
- **GIREP-ICPE-EPEC 2019** 1-5 July 2019, Budapest, Hungary
- **International Conference on Physics Education 2018: ICPE-SAIP-WITS** 1-5 October 2018, Johannesburg, South Africa
- **GIREP-ICPE-EPEC 2017: *Bridging Research and Practice in Physics Teaching and Learning*** 3-7 July 2017, Dublin, Ireland
- **The Second World Conference on Physics Education 2- 2016: *Contemporary Science Education and Challenges in the Present Society: perspectives in Physics Teaching and Learning*** 10-15 July 2016, Sao Paulo, Brazil
- **International Conference on Physics Education 2015: *Engaging Students in Physics – Research and Practice*** 9-14 August 2015, Beijing, China
- **GIREP-MPTL International Conference 2014** 7-12 July 2014, Palermo, Italy
- **International Conference on Physics Education 2014** 18-22 August 2014, Córdoba, Argentina
- **11th Interamerican Conferences on Physics Education** **Canadian-American-Mexican Graduate Student Physics Conference** 15-18 August 2013, Ontario, Canada

C14 Conferences (Continued)

- International Conference on Physics Education 5-9 August 2013, Prague, Czech Republic
- World Conference on Physics Education 1–6 July 2012, Istanbul, Turkey
- **International Conference on Physics Education ICPE 2011: Training Physics Teachers and Educational Networks** 15–19 August 2011, Mexico City, Mexico
- **Teaching and Learning Physics Today: Challenges? Benefits?** 22–27 August 2010, Reims, France
- **10th Inter-American Conference on Physics Education** 6-10 July 2009, Medellin, Colombia
- **International Conference on Physics Education** 18-24 October 2009, Bangkok, Thailand
- **International Conference on Physics Education: Building Careers with Physics** 11-16 November 2007, Palais des Congres, Marrakech
- **GIREP-EPEC 2007 Frontiers of Physics Education** August 26-31 2007, Opatija, Croatia
- **International Conference on Physics Education 2006** 15-20 August 2006, Tokyo, Japan
- 9th Inter-American Conference on Physics Education 3-7 March 2006, San Jose, Costa Rica
- **World View on Physics Education in 2005: Focusing on Change** 21-26 August 2005, New Delhi, India
- **What Physics Should We Teach? SAIP-ICPE International Conference** 5-8 July 2004, Durban, South Africa

C14 Conferences (continued)

- **8th Inter-American Conference on Physics Education** 7-11 July 2003, Havana, Cuba
- **Summer Course on Research in Physics Education** 15-25 July 2003, Rome, Italy
- **Physics in New Fields and Modern Applications** 5 August 2002, Lund, Sweden
- **Computer and Information Technology in Physics Education** 4-6 December 2001, Quezon City, Metro Manila, Philippines
- **International Conference on Physics Education in Cultural Context** 13-17 August 2001, Cheongwon, South Korea
- **Physics Teachers Education Beyond 2000** 27 August-1 September 2000, Barcelona, Spain
- **International Conference of Physics Teachers and Educators** 19-23 August 1999, Guilin, China
- **Hands-on Experiments in Physics Education** 23-28 August 1998, Duisburg, Germany
- **International Conference on New Technologies in Physics Education** 19-22 October 1998, Hefei, China
- **6th Inter-American Conference on Physics Education** 28 June-5 July 1997, Cordoba, Argentina
- **Creativity in Physics Education** 15-22 August 1997, Sopron, Hungary
- **Taller Iberoamericano de Enseñ de la Fisica Universitaria** Havana, Cuba
- **New Ways of Teaching Physics** 21-27 August 1996, Ljubljana, Slovenia
- **International Conference on Physics Education – New Movement of Reform on Physics Teaching** 5-9 August 1995, Nanjing, P.R. China
- **Teaching Modern Physics for Students Not-majoring in Physics** 24-28 July 1994, Sinai, Egypt

History Of ICPE

The following articles describe the first years of existence of ICPE:

- Leonard Jossem: PREFACE
- French: THE INTERNATIONAL COMMISSION ON PHYSICS EDUCATION
- William C. Kelly: WITNESS AT CREATION: I.C.P.E.’s FOUNDING AND EARLY YEARS

Future Development In Strategic Areas: Physics Education

- **IUPAP/C14 will continue to support the organization of physics schools, workshops, and conferences on physics education, particularly in developing countries.**

- **The Commission on Physics Education (C14) is creating a repository of open (non-commercial) virtual/remote laboratory resources used around the world.**

- **This information will be made available on the remodeled IUPAP website.**

- **The site will also be used to point to other teaching resources, particularly those of strong, long-established national associations that promote teaching/research in less developed countries.**

Development In Strategic Areas: Physics Education

- Science/Physics education needs a permanent renovation at college and university level. The IUPAP Commission on Physics Education addresses all these issues by facilitating sharing experiences across the world.

- The IUPAP is committed to taking actions so that access to education, resources, and advancement is available for all without discrimination.

- In particular, it will continue to support the organization of physics schools and of workshops and conferences on physics education, particularly in developing countries. It also expects to organize a variety of activities within the framework of the International Year of Basic Sciences for Sustainable Development such as collaborative projects among students of different countries and/or science fairs and contests for students of all ages. In doing so, it will challenge stereotypes about science and scientists and contribute to a more inclusive and diverse practice of this fascinating endeavor.

Collaborations with other Commissions within IUPAP

- **Physics for Development (C13)**
- **International Association of Physics Students (AC5 New) (I will meet with them tomorrow)**
- **WG2: Communication in Physics**
- **WG5: Women in Physics**
- **WG16: Physics and Industry**

Cooperation With Other Organizations and Learning Societies

- International Research Group on Physics Teaching (GIREP)
- UK Institute of Physics (IoP)
- European Physical Society – Physics Education Division (EPS-PED)
- Abdus Salam International Centre for Theoretical Physics (ICTP)

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 must fulfill two criteria: (1) the contributions to physics education should have extended over a significant 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).

Status of the initiatives arising from previous (2018-2021) C14 Commission Mandate:

- Assembling and publishing resources for virtual labs
- Ensuring active learning workshops at all IUPAP sponsored meetings initiative,
- Completing physics education panorama (being completed by our former Chair Dr. Roberto Nardi (Brasil))
- The third volume of the Handbook "Connecting Research in Physics with Teacher Education“ – just published

Education Panel at the Centennial Celebration Symposium

The symposium July 11-13, 2022 in Trieste, Italy

Education Panel at the Centennial Celebration Symposium

The Education Panel Themes

- The teaching and learning of physics: the role of experimentation and generic skills for physics graduates who could end up in diverse careers outside of the academy (especially industrial careers).

- Physics education curriculum: Does it appeal/attract/work for modern day students?

- Looking into the future of physics education: Given COVID-19 disruption how does physics education move forward and still maintain its disciplinary authenticity?

- How did physics teaching and learning change since we started our careers? How will it change in the future?

IUPAP Education Panel: The trajectory of physics curriculum and its impact on society

- What are the features of a purposeful and meaningful "**physics curriculum for 21st century** and its delivery"? How to optimize the continuum ranging from face-to-face to remote approaches prompted by the pandemic which is still ongoing in many parts of the world?

- How do we **engage today's students**? How to make physics more attractive to the modern students? Would teaching modern physics early on instead of introducing it later in the curriculum help better to engage students?

- What is the place of the **experimentation and 'generic skills'?** What other skills are important for work in the industry and for society?

- What **careers are expected for future students** outside of academia, including multidisciplinary, and non-traditional areas of employment?

- To summarize, the panelists will provide their insights on how physics teaching and learning has changed since they started their careers and how they envision the future of physics education. They will offer their views on "how physics education can move forward and still maintain its disciplinary authenticity".

Acknowledgments

This presentation includes information from Commissions' Chairs and Executive Council (CC&EC) meetings that took place January 25-28, 2022

The presentation contains the slides from the presentations of :

Dr. Michel Spiro (IUPAP President)
D. Silvina Ponce Dawson (Acting President Designate)
Monica Pepe Altareli (Centennial Symposium organizing committee)

My presentation is supported by the Faculty of Science Dean's Travel Fund, Toronto Metropolitan University (Formerly Ryerson University).

Get involved with IUPAP!

Thank you!

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