

International Union of Pure and Applied Physics Strategic Plan

The International Union of Pure and Applied Physics (IUPAP) is the only global International Scientific Union dedicated to physics that connects physicists from all fields and all continents. It is run by physicists for the benefit of physics and its applications and it depends essentially on volunteers to do its work. About to enter its second century of existence, IUPAP reaffirms its defining aims, expanding them to embrace current challenges and conditions. The Strategic Plan hereby presented is the result of numerous discussions enriched by the input of the diverse membership of IUPAP.

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 under-represented groups;*
- *Foster international cooperation and sponsor suitable international physics meetings;*
- *Promote the free circulation of scientists and the open access to data;*
- *Enhance the vital role of early career physicists;*
- *Strengthen the links with physicists working outside academia and with other scientific communities;*
- *Uphold openness, honesty and integrity in the practice, application and promotion of physics;*
- *Promote international agreements on symbols, units, nomenclature and standards.*

Context

IUPAP has been advancing physics across international boundaries for almost 100 years. Thirteen countries established the organization in Brussels in 1922. Today there are 60 member territories from around the world.

The governance of the Union is carried out according to its Statutes (<https://iupap.org/about-us/statutes/>) and Bylaws (<https://iupap.org/about-us/statutes/bylaws/>), with ultimate authority residing in its General Assembly (GA), normally held every three years in different countries. Due to the Covid19 pandemic, the 2020 GA was postponed to 2021. Between the General Assemblies the Executive Council governs the affairs.

At present, the income of IUPAP is primarily derived from the dues paid by its members, supplemented from time to time by grants to carry out specific projects. Currently, there is only one administrative staff member, so that most of the work is done by some 350 volunteer physicists. IUPAP is currently structured in 19 specialized commissions that promote the objectives of the Union in their respective areas of expertise, six affiliated commissions and thirteen working groups.

Vision

IUPAP abides by the principle of the universality of science, which, in turn, is an aspect of the unity of human knowledge, based on empirical data. It embodies and promotes the unity of physics by strengthening international cooperation within the physics community and fostering freedom of movement, association, expression and communication for scientists, as well as equitable access to data, information, and research infrastructures and materials. IUPAP considers that collaboration across countries, communities, disciplines and physics fields is enriching and necessary to advance towards a comprehensive understanding of nature and to develop solutions to the many problems that humanity faces. In this regard, basic and applied sciences cross-fertilize one another and support for one is essential to advance the other.

IUPAP wholeheartedly opposes any form of discrimination on the basis of such factors as sex, gender, race, color, ethnic or social origin, language, religion or belief, disability, age or sexual orientation. It strongly believes that diversity is essential to delivering excellence in science and that the full participation of people from the widest range of backgrounds and experiences is not only a moral obligation but will enhance scientific creativity and innovation. IUPAP is also greatly committed to the ideal that everyone should have the opportunity to contribute to and benefit from the advancement of science, as a basic human right, and to the work required to achieve it.

IUPAP is deeply engaged in promoting the study of physics and related fields, in the understanding that many human endeavors, whether involving the environment, climate change, energy, materials, communications, urban and rural development, or human health, will benefit directly or indirectly from advances in the various disciplines of physics. To this end, IUPAP strongly endorses the engagement of students with evidence-based tools for the teaching of physics. It strongly promotes physics-based innovation, entrepreneurship and commercialization for their positive impacts on society.

Increasing the general scientific literacy of the world is fundamental to empowering citizens to make informed decisions on various aspects that affect their lives, allowing them to identify and share reliable information, and becoming more discerning of information received. IUPAP is greatly committed to improving the perception of the public of the value of science, of scientific expertise and of science-based policy.

IUPAP is firmly in favor of all actions that will help to achieve sustainable development and a more balanced and inclusive world. Creative interventions are necessary to advance in this regard, for which the contributions of physics and science are key. IUPAP provides an international platform where scientists can raise their voices and express their views on any matter that relates to physics and the practice of physics in this world, and in so doing help to propose solutions and action plans to address such matters. This enables physicists to participate in decision-making that impacts physics on an international level in significant ways. IUPAP's unique expertise can be put to good use in providing expert evidence-based advice to governments on current and future global challenges.

IUPAP thinks that scientific integrity is indissolubly linked to the practice of science. Thus it is deeply committed to promoting scientific and ethical standards that will help to eliminate research misconduct, handle conflicts of interest, increase transparency and induce the internalization of values such as trust, accountability and fairness. These values are essential for collaborative work and for the way in which the results of scientific research are perceived by the general public. The creation of a new Affiliated Commission on the History and Philosophy of Physics and the appointment of a Vice-President at Large with responsibility for Outreach and Ethics will help IUPAP examine its own procedures and make sure that they align with the required ethical standards.

Action Plan

To advance IUPAP into the future along the lines just described, its Executive Council is planning to execute the actions listed below.

Short-term projects

International Year of Basic Science for Sustainable Development

IUPAP is leading fellow unions and other partners to promote and to organize an International Year for Basic Sciences for Sustainable Development (IYBSSD) in 2022/2023. While applications of technology as key elements of modern society are relatively easy to recognize, the crucial role that fundamental or basic sciences play in the process is often only poorly appreciated, if at all. To address this shortcoming, bridges need to be established between policy makers, scientists, diplomats, governmental and civil society organizations, entrepreneurs, companies and individuals. This would provide an accurate understanding of the ways in which science, technology, and society are connected within a healthy, innovative eco-system, emphasizing the role of fundamental research. Basic sciences are also key to advancing the goals and targets of the UN 2030 Agenda for Sustainable Development in achieving the following:

1. Reducing poverty and hunger;
2. Protecting the planet from degradation, sustainably managing its natural resources and taking urgent action on climate change;
3. Ensuring that economic, social and technological progress occurs in harmony with nature and
4. Fostering peaceful, just and inclusive societies which are free from fear and violence.

In 2019 UNESCO recommended that the United Nations proclaim this International Year. IUPAP is working hard to bring the UN proclamation into place.

Celebrations for the Centennial

IUPAP will celebrate its Centennial in 2022/2023. Several initiatives are being planned for this important anniversary. They include a Centennial Symposium, as one of the events for the IYBSSD, given that the IUPAP's work on promoting physics and science for development will be a major part of its centenary celebrations. It will arrange for dedicated talks in large IUPAP-sponsored physics conferences to publicize all these activities. We will encourage the various commissions and national physics communities to organize satellite events worldwide.

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.

Public profile and visibility

IUPAP will take various actions to make the physics community more aware of its mission and role in the international promotion of physics and physics education as well as diversity. It is starting a major remodeling of its website where there will be links to sites with useful resources for physics research, outreach and education. We are planning to post physics news regularly on the website and allow individuals to subscribe to the newsletter. We also expect to have a more active presence on social networks.

The celebrations for the Centennial and the events related to the IYBSSD will certainly contribute to increasing visibility.

IUPAP organization, membership and relations

Administrative structure

With the end of the agreement with the Nanyang Technological University (NTU) in Singapore, which hosted IUPAP administration and company from 2015 to 2020, IUPAP is revisiting its administrative structure. Instead of having a fully centralized administration moving from one continent to the other every six years, it is considering a more stable configuration through its transformation into a new Swiss based association, which will designate an Administrative Office in charge of the administrative work, the organization and maintenance of the Website and the secretariat of Conferences.

New legal structure

IUPAP changes its legal structure and becomes a Swiss based association. The new Statutes (called Articles of Association) and Bylaws (called Internal Regulations) incorporating the Swiss association will hopefully be approved at the next 2021 General Assembly. These new Statutes and Bylaws will reflect the changes that the increasing physics community has experienced since the last time they were changed, formally incorporate what has become common practice in recent years and include new best practices generated by the COVID-19 pandemic.

Membership

IUPAP will continue with active recruitment of new members to strengthen itself and expand its worldwide connections. Increasing its membership is intimately connected with promoting the organization internationally and keeping the world of physics informed about the roles that IUPAP is playing in strengthening the discipline on a world-wide scale. Invariably, increased membership means more resources. This enables IUPAP to do more with and for physics for the benefit of humanity. This means more support for IUPAP-related activities such as the annual commission conferences, workshops, working group meetings etc., which are open to the international world of physics.

IUPAP will also analyze the prospect of reaching out to a wider community, including the possibilities of corporate associate membership.

Relation with national and regional physical societies

The actions to engage physical societies and physicists directly with IUPAP are closely related to those that will give it more visibility. To advance in this regard we started to liaise with regional physical societies inviting them to send representatives to IUPAP Council and Commission Chairs Meetings and General Assembly. We are planning to explore the organization of joint activities, particularly the co-sponsorship of conferences or of talks within conferences. This can be a way to strengthen relations with national and regional physical societies.

IUPAP will also seek to foster new physics societies in those countries where physics is at early stages of development/organization, using "sister societies" in the same geographic/cultural region to help local physicists in organizing physics activities.

Physics outside academia

The majority of physicists do not work in academia, but rather in environments such as industry and government. IUPAP has established a working group on physics in industry to help us develop better connections with those physicists and to use the connections to enhance the use of physics to promote development. IUPAP promotes physics-based innovations that have the potential for commercial applications with impacts on the economy and on society in general.

Early Career Physicists

Through its prestigious *Young Scientist Prizes*, with over 220 awarded so far, IUPAP has enhanced the recognition of the vital role that early career physicists play. We plan to build on this by finding more ways to incorporate these physicists into the activities of the Union. We will also explore the possibility of obtaining specific funds to finance research equipment associated with the awards. This would add to the research capabilities of the institutions of less-privileged physicists.

IUPAP has recently established an Interdisciplinary Young Scientist Prize to recognize the accomplishments of early career scientists who do research in interdisciplinary areas. We will begin with prizes that will be awarded by more than one IUPAP Commission then move to a more diverse conjunction of fields.

It is important to make people aware of the different avenues available for pursuing a career in science beyond the standard academic path. We will raise awareness of these different options and help develop strategies for the retention of young physicists.

Physics students

IUPAP has established close ties with physics students. In that regard we are planning to create an Affiliated Commission with participation of members from the International Association of Physics Students (IAPS). As a first step, representatives of IAPS have participated in the Council and Commission Chairs Meeting, which was held virtually in October 2020.

Interdisciplinary collaborations and Inter-Union activities

IUPAP is planning to create an Affiliated Commission on the History and Philosophy of Physics with members of the International Union of History and Philosophy of Science and Technology (IUHPST) and of the physics community with interest in the subject. The existence of this commission will, among other things, assist IUPAP in reconstructing its history, addressing many ethical issues of great current concern. Among the latter are discussions of the social impact of new technologies or aspects related to scientific misconduct, conflict of interests, and good practices.

Over the last three years the IUPAP played a key role as member of the Executive Committee of an interdisciplinary project to analyze and help reduce the Gender Gap in the Mathematical, Computer and Natural Sciences. In particular, IUPAP was one of the unions responsible for the realization of a Global Survey of Scientists that collected about 34,000 responses from all over the world. This project involved the collaboration of eleven international partners, many of which, including IUPAP, decided to act as Founding Partners for the establishment of a Standing Committee for Gender Equality in Science (SCGES). The aims of this committee are to further promote gender equality in science by continuing and enlarging the work accomplished by this project, and in particular by supporting equal access to science education for girls and women, and fostering equal opportunity and treatment in their careers.

Boundaries between physics and other disciplines have become less rigid and science has become more interdisciplinary than ever before. IUPAP is now actively collaborating with other unions on the organization of the IYBSSD. We will build on this joint work to forge new formal alliances with other unions.

Presence in international bodies

IUPAP is an active member of the International Science Council. It will continue to contribute to this non-governmental organization, which brings together 40 international scientific Unions and Associations and over 140 national and regional scientific organizations including Academies and Research Councils. The Union is planning to enhance its participation in the Council's activities contributing to various projects of interest.

New developments in established activities

International conferences and virtual meetings

IUPAP will continue to support international conferences, and provide encouragement that they be held in different regions of the world while guaranteeing the diversity of participants, speakers and committee members in an environment free of harassment and discrimination. In 2020 many meetings were held remotely. This had the advantage of saving cost and time allowing the participation of more students and international attendees and reducing the carbon footprint. The disadvantages were the lack of personal contact, which is essential for networking and the requirement of a good Internet connection, which is difficult in a large part of the developing world. IUPAP will explore the option of promoting the organization of mixed conferences in which several related activities are organized simultaneously in different parts of the world and then linked virtually.

Another problem associated with virtual meetings is that the access to certain platforms is restricted in some countries due to governmental regulations. IUPAP will take this into consideration for the sponsorship of future virtual conferences, by requiring that organizers propose the use of platforms with global worldwide access or that they allow for more than one way of connecting to the conference.

IUPAP will also formulate good practices for virtual meetings.

International collaborations, free circulation and accessibility

IUPAP has long worked to ensure that the interaction between physicists from different countries, which is key for the progress of physics, can continue even when relations between the countries' governments are strained. In the present international climate this activity is as important as ever.

Physics increasingly involves international collaborations in the planning, construction and operation of common infrastructure and in the analysis of the resulting data. IUPAP will work towards reversing the current trend by some countries to restrict access to facilities, data and methods of communication. While nations have legitimate needs to protect their critical facilities and computing systems, we think that they also have a responsibility to find ways to maintain and facilitate access for all international scientific collaborators.

Future development in strategic areas

Physics education

IUPAP 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) has decided to create 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.

Outreach, scientific literacy and contribution to policy making

IUPAP has recently renamed one of the Vice-Presidential positions as Vice-President at Large with responsibility for Outreach and Ethics, in anticipation of having an increasing role in science outreach in the coming years. IUPAP's contributions in this regard will be realized through activities that it is organizing for the Centennial and those associated with IYBSSD, and will be advertised with specific content on its remodeled website and via a more active presence on social networks. IUPAP will also promote the engagement of all members of the physics communities represented in IUPAP with communicating the wonders of physics to mainstream society in easily understandable and attractive ways.

The renovated communication scheme will also be used to enhance the public understanding of science and contribute to evidence-based policy decisions.

Sustainability and physics for development

IUPAP will continue to support conferences, schools and workshops in developing countries. The Commission on Physics for Development (C13) will assist IUPAP in cosponsoring at least three workshops per year in developing countries. It will also be managing the Light sources for Africa, the Americas, Asia, Middle East and Pacific Program (LAAAMP) in collaboration with the International Union of Crystallography and the Abdus Salam International Centre for Theoretical Physics with the support from the International Science Council.

IUPAP will increase its support to developing countries within the framework of IYBSSD and expect that many activities will be organized worldwide to raise awareness of the usefulness of basic science for sustainable development and the need to support it.

Gender, diversity and inclusiveness

IUPAP has a long-standing commitment in support of diversity in physics. It created the Working Group on Women in Physics in 1999 and the position of Vice-President at Large with Gender Champion responsibilities in 2011. It established a set of guidelines for the

sponsorship of conferences to guarantee that women are fairly represented among participants, speakers and members of committees and that conferences take place in an atmosphere free of sexual harassment and discrimination. The writing of the Waterloo Charter for Women in Physics, where the guiding principles of IUPAP in this regard are set, was finalized and hopefully will be approved by the 2021 General Assembly. This continuing work has also progressed in a joint effort with unions of other disciplines as explained elsewhere.

IUPAP is planning to build on this still-necessary work on gender by focusing on other areas where there is discrimination, conscious or not, such as disability and ethnicity.

Ethics, science integrity and good practices

There has been a significant increase in solicitations to contribute to predatory journals and conferences. Such vulturine practices not only could have financial consequences, such as the potential of investing in fake publications, but also the lack of serious peer reviews could result in “fake science”. This could significantly undermine trust in science. IUPAP will take a lead in seriously combatting such predatory and/or fake practices in physics and applied physics.

With the contribution of members of the Affiliated Commission on the History and Philosophy of Physics that will soon be established and of the Vice-President at Large with responsibility for Outreach and Ethics IUPAP will be in an excellent position to define a set of guidelines that will promote scientific and ethical standards and address ethical issues of great current concern as mentioned elsewhere.