

Invited paper

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Women in physics

Actions of the International Union of Pure and Applied Physics and their impact in Latin America

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Abstract: The International Union of Pure and Applied Physics (IUPAP) is the scientific union representing identified physics communities from all over the world. It currently has 60 country members and is organized and run by the physics community itself. About to turn one hundred years old, the IUPAP has taken several actions for over 20 years to increase the participation and improve the situation of women physicists. The creation of its Working Group on Women in Physics in 1999 has had an enormous impact on the physics communities giving visibility to a problem that had often gone unnoticed, raising awareness and, most importantly, creating a very active network of women physicists in more countries than IUPAP members. The Working Group has also had a direct impact on the IUPAP's organization and on the activities it sponsors. In this paper I give a brief account of the actions of the Working Group and of the measures that the IUPAP has taken since 1999 to help reduce the gender gap in physics and in STEM. I then focus on the many activities that it led to in Latin America, the region of origin of three of the five chairs of the Working Group.

Keywords: Gender gap; IUPAP; Latin America; science; STEM; women in physics.

Introduction

The International Union of Pure and Applied Physics (IUPAP) was established in 1922 “to assist in the worldwide development of physics, to foster international cooperation in physics, and to help in the application of physics toward solving problems of concern to humanity.” In its almost 100 years of existence the IUPAP has not only increased the number of its members from the initial 13 countries representing identified physics communities to about 60 at present, but has also expanded its original aims in view of the many changes that have occurred in science and society over the past century. One of the issues that the IUPAP has addressed for more than 20 years now is that of increasing the participation and improving the situation of women in physics. Even if the number of women with access to higher education has steadily grown in most countries, gender inequalities are still present in all societies. Advancing in this regard constitutes one of the Sustainable Development Goals of the United Nations and is a key component of the UN 2030 Agenda. The scientific community is not an exception. Differences in recruitment, retention and career progression can be observed in all disciplines. Women's careers are much more affected by personal matters than those of men. In spite of great recent advances, women still need to confront stereotypes and, very frequently, suffer gender violence and discrimination.

The 23rd IUPAP General Assembly approved the creation of the IUPAP Working Group on Women in Physics (WGWiP) in 1999. Since its very beginning, the group had an enormous impact on the physics community of many countries. It not only put the issue on the agenda of these communities, raising awareness

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about the problems faced by women physicists, but, most importantly, it led to the creation of an active network of women physicists that extends over many more countries than IUPAP members. The resolutions and recommendations of the Working Group also had an impact on the structure of the IUPAP and on the activities that it promotes and sponsors. The IUPAP has three ways to induce change. First, it can impose rules on its own organization so as to guarantee the fair participation of women in its governing bodies and structure. Second, it can establish requirements on the activities that it sponsors and endorses. Finally, it can issue statements, declarations and recommendations that are disseminated among the physics communities that are represented by its members. The IUPAP has advanced along these three lines, starting with changes in its own organization. It has also taken “top-down” measures that are imposed on those seeking the support of the union for their activities and has recommended policies for the communities to uptake. The direct involvement of all members of the scientific community is absolutely necessary to produce the cultural change that will make the practice of physics and of science more inclusive and diverse, thus, more human.

In what follows I first describe some of the activities carried out by the IUPAP WGWP. I then present a summary of the main decisions that, based on the recommendations of the Group, the IUPAP has taken over the years to increase diversity and inclusion in the practice of physics. I finally give an account of the impact that the measures taken and promoted by the IUPAP have had on the scientific communities of Latin America, including a description of some of the activities that are regularly organized in the region.

The IUPAP Working Group on women in physics

The IUPAP Working Group (WG) on Women in Physics (WIP) was created in 1999 to survey the situation of women physicists in IUPAP member countries, to analyze and report the data collected along with suggestions on how to improve the situation and to suggest ways to increase the participation of women within the IUPAP structure. Although the group was initially created for a limited period of time, all the General Assemblies have approved its continued existence since then. These decisions were based on evidence that shows that there is still a gender gap which needs to be reduced.

One of the first actions of the WG was to promote the creation of local working groups in as many countries as possible giving them the task to collect information on the situation of women physicists at a local level. Representatives of the country teams were then invited to present their data at the First International Conference on Women in Physics (ICWIP) that took place in Paris, France, in 2002. The first ICWIP had more than 300 participants from 65 countries. At the conference the results of two surveys run by the Statistical Research Center of the American Institute of Physics (AIP) were also presented. The questionnaires for these surveys were in English and had received 1000–2000 responses. The year 2002 signaled the beginning of the series of ICWIPs that were organized triennially ever since (Rio de Janeiro, Brazil, in 2005; Seoul, South Korea, in 2008; Stellenbosch, South Africa, in 2011; Waterloo, Canada, in 2014; Birmingham, UK, in 2017; Melbourne, Australia, which will actually be held virtually in 2021 after its postponement due to the 2020 Covid pandemic). The participation at ICWIPs is by country team, with a cap on the number of participants per country so that none of them overwhelms the others. Travel grants are awarded to representatives of developing countries which requires a large effort by the WG to raise the corresponding funds. The participation of at least one graduate student and a man per country team is encouraged. The structure of the first ICWIP has more or less persisted over the years with some modifications. Currently, there are plenary talks by women physicists that combine a description of their research with an account of their personal lives. There are country poster sessions where country teams report on their local situation. There are scientific poster sessions where participants show their scientific work and liaise with other participants. In recent years, both poster sessions have been complemented with 3 min oral presentations of all the posters. There are parallel break-out sessions where gender-related topics are addressed. Some of them are training sessions that seek to contribute with the professional development of early career participants. These break-out sessions are supposed to produce recommendations that are then discussed at the final Conference Assembly. ICWIPs have always been organized immediately before the IUPAP General Assemblies (GA). In this way some of the recommendations of the

conference assembly are drafted as resolutions to be approved by the IUPAP GA [1]. Lately, all ICWIPs also have outreach activities for the general public or for school kids. Conference proceedings of all ICWIPs have been published by the American Institute of Physics [2–7]. They contain papers based on the country and scientific posters, on the plenary talks and on the break-out session discussions.

The resolutions and recommendations that came out of the six ICWIPs have served as inspiration for the development of new policies in many countries. They also led to changes in the IUPAP structure and on the activities it sponsors. In fact, recommendations are intended for individuals, physical societies, the WG, the IUPAP and other key players of the physics community. We quote some of them in what follows:

- Scientific and Professional Societies should foster gender equality having a group examining policies, making available statistics on the participation of women, identifying leading women physicists and promoting them as role models.
- Funding Agencies should ensure that there is no gender bias in the broad based general grant funding process, and that women are included on review and decision making committees. Limits on age of eligibility or grant duration that seriously disadvantage applicants taking family leave should be reconsidered. Statistics should be made available giving by gender the proportion of successful applicants.
- All Institutions should note that family oriented practices such as flexible work schedules, opportunities for dual career families, and child care facilities increase the opportunities for women in science and technology.
- The IUPAP should require the organizers of the conferences it sponsors to improve the inclusion and encouragement of women, and request its member societies and other scientific unions to do the same.
- The IUPAP should encourage its commissions and member countries to have a clear and transparent list of criteria for awards ensuring that women are nominated for prizes and that there are women on the selection committees for prizes and awards.

Reducing the gender gap in science requires a cultural change. To this end, raising awareness within the scientific community and getting their members directly involved in the definition and development of new policies is key. In this regard, having a network of motivated people is most helpful. The way in which participation in the first ICWIP was organized, which was kept inalterd since then, was the seed for the now thriving network of women physicists that spans over more countries than IUPAP members. ICWIPs give the opportunity for the members of this network to meet, discuss policies, exchange ideas on science and gender-related issues and learn from regional differences. They are also the platform for the establishment of mentoring schemes and disciplinary and regional networks. It was through the participation in ICWIPs that the very active group of Latin American women physicists was formed. Although the Conference Proceedings constitute a very useful report of the main issues addressed at ICWIPs, they are unable to capture the unique atmosphere that prevails at these gatherings. Narrative accounts by some of the Latin American participants of the conferences are included at the end of the book we have recently published on the gender gap in science in the region [8]. We quote here one of them: “The 2014 ICWIP was the most inspiring and amazing meeting I have been to in years! It helped a lot my career to share work experiences with other women and to learn how other countries and societies deal with gender issues.”

The activities carried out by the WG are not limited to the organization of conferences or issuing resolutions and recommendations. The years with no ICWIPs, travel grants are awarded to women physicists, preferably at early stages of their careers, and physics students, from developing countries, that are willing to participate in physics conferences, workshops or schools outside their home institutions. The program started in 2003 and has been continued ever since. During the first years, applications from Eastern European countries were also accepted. The WG makes the selection of the awardees. In 2012, the number of applications was 83 and the number of grants awarded was 22. These numbers were, respectively, 64 and 15 in 2013, 100 and 26 in 2015, and 30 and 23 in 2016. Over the years, grants were awarded to women from Armenia, Argentina, Belarus, Brazil, Cameroon, Chile, China, Congo, Croatia, Cuba, Egypt, Ghana, Hungary, India, Iran, Kazakhstan, Kenya, Mexico, Peru, Serbia, Tunisia, Uganda, Zambia among others. This gives some idea of the extent of the program. It does not reflect, however, the impact that the grants have on the careers of the

awardees. An account of the program's impact, including the testimony of an Argentinian woman physicist, can be found in the September-2019 Newsletter of the IUPAP [9]. More information on the awardees can be found at the Working Group website (see Table 1).

Another major activity that the WG was involved in was the Global Survey of Physicists that was open for responses in 2009–2010 [10]. The survey, available in eight languages, was implemented and analyzed by the Statistical Research Center of the American Institute of Physics (AIP), as in the previous (smaller and women only) surveys of 2001–2002. The questionnaire was developed by the AIP group in close collaboration with the WG and some country team leaders. In particular, native speakers of languages other than English supervised the translations. The survey collected about 15,000 responses from 130 countries, 75% of them, highly developed. Women respondents were 21% among those from developed countries and 27% in the case of less developed ones. Less than 30% of the responses came from (the mostly graduate) students. Put altogether, these numbers might indicate a slight over-representation of women among the respondents with respect to the physics community composition at the time. Namely, according to the 2019 Report of the AIP Statistical Research Center [11], women earned ~21% of the physics bachelors' degrees in the USA in the period (2007–2017) while the fraction of women earning physics doctorates increased steadily over that period reaching ~20% in 2017. We could then expect a smaller percentage of women within the active physics community of developed countries at the time of the survey (2009–2010). Although the fraction of women physicists is larger in many developing countries, 27% is also a bit too large. In particular, the fraction of women physicists affiliated with the National Research Council of Argentina (members of its "Researchers Career" in the area of physics) was ~22% in 2010 and increased to ~26% in 2017 [12]. Regarding the total number of responses, it might represent ~1.5–4% of the worldwide community of physicists which was estimated to be ~(400,000–1,000,000) in 2015 [13].

The survey showed that early educational experiences are equally important for men and women to choose to study physics. It also showed differences between genders and between more or less developed countries. Regarding personal lives, the responses portrayed a very traditional family organization with men physicists being much more likely than women to have spouses that earned less than they did, who did not work or who were in charge of the domestic chores. The difference was larger in the case of highly developed countries: 7% of the women respondents from developed countries and 5% from developing ones said that their spouses were not employed while 33% of the men respondents from developed countries and 23% from developing ones gave this answer. The difficulties in compatibilizing personal life and profession were also reflected in the responses about how becoming a parent affects career progression. In that regard, while 31% of the women respondents with children reported having progressed more slowly than their colleagues, this fraction dropped to 22% among men with no children, to 21% among women with no children and to 14% among men with children [14]. Differences in the time at which women and men from more or less developed countries became parents were also observed. About 40% of the women respondents from developing

Table 1: Useful links.

Organization	Website
IUPAP	https://iupap.org/
IUPAP Working Group on Women in Physics	http://wgwip.df.uba.ar
AIP Statistical Research Center	https://www.aip.org/statistics
Gender Gap in Science Project	https://gender-gap-in-science.org/
Gender Gap in Science Latin America	https://wp.df.uba.ar/ggapsla/
Network of Science, Technology and Gender	http://www.redciteg.org.mx/
SCGES	https://gender-equality-in-science.org/
AAS Committee on the Status of WiA	https://aas.org/comms/cswa/news/
IoP Diversity & Inclusion	https://www.iop.org/about/IOP-diversity-inclusion/
ICTP, Trieste, Italy	https://www.ictp.it/

countries with children said they had them after university and before their doctorate. Regarding the rest of the respondents with children, 25% of the men from developing countries and 15% of the women and 10% of the men from developed ones had their kids at that stage of their careers [14]. This could certainly have a different impact on their career advancement. Differences among generations and between more or less developed countries with respect to having children or not had been observed in the First Survey of Physicists which was conducted in 2001 and responded solely by women [15]. Namely, more than half of that survey's respondents from developed countries and less than one-third of those from developing ones did not have children. Among respondents over age 45, about one-third from developed countries and only one in 10 from developing ones did not have children. The data collected through the Global Survey of Physicists highlighted differences in family organization and family related decisions that are more likely to interfere with the career's advancement of women than of men. Other responses reflected differences in attitudes between men and women. About 50% of the women respondents from developing countries said that they felt mostly comfortable raising concerns with their boss. This percentage rose to 59% in the case of men respondents from developing countries and to 61 and 70%, respectively, in the case of women and men respondents from developed ones. Regarding their scientific careers, the responses showed that women had a harder time than men finding opportunities to advise graduate students, to serve as journal editors or on influential committees, to have an international work experience and to receive invitations to speak. Sadly, not much advancement with respect to this situation has been observed with the Global Survey of Scientists that was open in 2018 which we describe in the section "Collaboration with other international scientific unions".

IUPAP policies to increase inclusiveness and diversity in physics

Besides the creation and continuous renewal of the WG on Women in Physics, the IUPAP has taken other measures to increase diversity and inclusiveness in physics. The 2011 GA approved the proposal to select a Vice-President at Large with Gender Champion duties. The first chair of the WG, Marcia Barbosa, was the first person selected for the job. The aim of the position was to strengthen connections between the IUPAP commissions and the WG on Women in Physics and to assist the IUPAP in tracking the representation of women in all IUPAP activities. Most of the financial efforts of the IUPAP go to into the sponsorship of international conferences. Among other things, the Gender Champion is in charge of collecting the data on women's participation at these conferences. Based on these data, the IUPAP has passed a set of rules to guarantee that women are represented as organizers, speakers and attendees of its sponsored and endorsed conferences and that conference participants receive information on inclusiveness in physics. An anti-harassment policy has also been established for such conferences.

The 2017 GA established, as a recommendation for all affiliated national institutions, that a 20% target of women participation in conferences should be achieved. This rule also applies to conferences sponsored or endorsed by IUPAP. In particular, those seeking IUPAP's support need to provide information on the fraction of women among invited speakers and committee members in the application form. It has also been determined that meetings in which the proportion of women speakers and committee members is less than 10% will not be accepted. Conference organizers have a deadline of a few weeks to make the necessary corrections to abide by this rule. Waivers can eventually be granted in very exceptional cases. When the conferences are over, their organizers have to turn in a report that must include the statistics on women's participation among attendants and speakers. An analysis of the conferences sponsored by the IUPAP in 2017 and 2018 showed an average of 19% women participants and 17% of women invited speakers, not too different from the desired (minimum) target of 20%. The 2017 GA also approved a resolution stating the "need to encourage IUPAP-sponsored conferences to have a session for all participants on Diversity and Inclusion in Physics." Examples of possible activities include a plenary session or talk, an exhibition, a survey or any type of activity to which all participants should be exposed. At the 27th IUPAP Statistical Physics Conference (StatPhys27) that was held in Buenos Aires, Argentina, in 2019, for example, a 20 min plenary session on inclusion and diversity was

organized describing the history and policies of the IUPAP to advance in these aspects. An informal gathering of people interested in gender-related issues was also organized at the end of the days of the conference.

Sexual harassment is of great concern across communities. IUPAP supported conferences must now publish on their websites and in all publications related to the conference a specific statement on harassment. Among other things, the statement says: “The conference organisers will name an advisor who will consult with those who have suffered from harassment and who will suggest ways of redressing their problems, and an advisor who will counsel those accused of harassment.” Initially the statement included a phrase about the possibility of expelling the harasser from the conference without refund of their registration fee. The possibility of taking this action, however, was observed by some national physical societies because it interfered with anti-discriminatory local legislation. Clearly, the relatively short duration of a conference does not allow a fair assessment of the situation. From the point of view of the IUPAP regulation, the solution was to remove the mention to the expulsion from the statement. Having the statement can discourage people to harass others at conferences, but it will not prevent it from happening. This again requires a cultural change with a deep involvement of scientific community members. It is through dialogue and reflection that this change can be induced. This is why having activities where this type of problems are made visible are very important.

At the 2014 ICWIP that took place in Waterloo, Canada, the conference assembly proposed the writing of a declaration of principles drawing inspiration from the Baltimore Charter and the Pasadena Recommendations of the American Astronomical Society (AAS). To this end, it committed the WG to write the first draft. This led to the *Waterloo Charter on Women in Physics* that was subsequently discussed and amended at the following ICWIP, in Birmingham, UK, in 2017. As Vice-President with Gender Champion duties, I presented it at the 2018 meetings of the IUPAP's Council and Commission Chairs whose participants suggested further changes and corrections. The Charter is not only a declaration of principles. It is also endowed with a long list of recommendations for a more inclusive and diverse practice of physics. The Baltimore Charter and the Pasadena Recommendations that inspired the Waterloo Charter can be found at the website of the Committee on the Status of Women in Astronomy (WiA) of the AAS (see Table 1). Another source of inspiration was Project Juno of the UK Institute of Physics. The Charter also includes all the statements on gender equality and inclusiveness in physics that the IUPAP had previously issued. The final version of the Charter, which we expect will be approved at the 2021 IUPAP GA, can be downloaded from the Working Group webpage (see link in Table 1) and will soon be available at the remodeled website of the union.

The actions to increase the participation of women physicists also had an impact on the structure of the IUPAP. Even though specific quotas are not currently mandatory, the gender composition of the commissions is under close scrutiny to make a fair selection of members. The new commissions that are to be approved by the GA in 2021, which was postponed in 2020 due to the Covid pandemic, have a larger fraction of women than the preceding ones. In particular, eight of the chairs proposed for the 18 commissions are women. A new set of statutes and bylaws is expected to be approved at the 2021 GA. Regarding commissions they state that at least one of the officers (Chair, Vice-Chair and Secretary) should be a woman. Regarding the presidency of the Union, they state that “Normally, at least one of the President, President-Designate and Immediate Past President will be a woman, and at least one shall be a man.” In fact, I have been appointed Acting President Designate in 2019, after the resignation of the then President, Kennedy Reed. Provided that my designation is confirmed by the GA, I will eventually become the second woman president of the IUPAP, after Cecilia Jarlskog who presided over the union in 2011–2014.

Collaboration with other international scientific unions

Five years after having carried out the Global Survey of Physicists, the WG felt the need of running a new one. We were looking for possible funding options when the International Science Council (now ISC, then ICSU) issued a call for proposals in 2016. The call required that the projects be led by two of its members (typically, international scientific unions). We thus initiated conversations with representatives of other scientific unions to present a joint project on gender in science that could include the realization of a survey among its tasks. At

the time the inter-union collaboration was an obligation to abide by the rules of the call. It turned out to be an incredibly rich, fruitful and rewarding endeavor in which we all learned from one another. The collaboration led to the project entitled “A Global Approach to the Gender Gap in Mathematical, Computing, and Natural Sciences: How to Measure It, How to Reduce It?” which with the leadership of the International Mathematical Union (IMU) and the International Union of Pure and Applied Chemistry (IUPAC) was presented to the call. The project was awarded one of the three grants that were given at the time. The project had three main tasks: a global survey of scientists, an analysis of publication patterns discriminated by gender and the elaboration of a good practice database. Representatives of the project's 11 international partners met for the first time in Paris in 2017. Later that year, regional workshops were organized in Asia, Africa and Latin America where, among other things, the draft of the survey's questionnaire was analyzed and discussed to incorporate regional perspectives. The survey became open for responses in seven languages in May, 2018. Through the end of that year it received about 34,000 responses from 159 different countries that were analyzed by members of the Statistical Research Center of the American Physical Society. On several aspects, the responses were strikingly similar to those of the Global Survey of Physicists of 2009–2010. Overall, the survey showed that the experiences of women scientists in their work and educational environments are consistently less positive than those of men. Not all the findings of the project were negative, however. The study of publication patterns showed the growth of women's participation in high impact journal papers in certain disciplines, particularly, in astronomy. Knowing about the many initiatives that exist across the world to help reduce the gender gap in STEM was also positive. The project had a closing activity at the Abdus Salam ICTP in Trieste in November 2019. Its final report was published as a book [16] that is available for download or print on demand (for more details, please visit the Gender Gap Project's website).

Although the ISC funding came to an end in 2019, the project is still active, holding regular virtual meetings and starting to make the results of the survey available for interested researchers. Most of the project partners, on the other hand, decided to formalize their relation through the creation of the Standing Committee for Gender Equality in Science (SCGES, see Table 1). The founding partners of this committee are the International Astronomical Union (IAU), the International Council of Industrial and Applied Mathematics (ICIAM), the International Mathematical Union (IMU), the International Union of Biological Sciences (IUBS), the International Union of History and Philosophy of Science and Technology (IUHPST), IUPAC, IUPAP, the Association for Computing Machinery (ACM) and Gender in Science, Innovation, Technology and Engineering (Gender-InSITE). It is expected that this committee will lead to a continuous collaboration across disciplines that will eventually extend to other aspects besides gender equality. This is a common feature of the actions that are usually taken to help reduce the gender gap. They have a positive impact beyond gender issues leading to policies that improve the environment for all.

Activities in Latin America and IUPAP's impact in the region

The contributions of Latin American women physicists have been very relevant for the IUPAP's WG on Women in Physics since its very beginning. The Brazilian physicist Marcia Barbosa was the first Chair of the group and, as such, was the one who set the bases for the formation of the network of women physicists that exists at present. The first ICWIP had representatives from Argentina, Brazil, Colombia, Cuba and Mexico. Subsequent conferences also included representatives from Peru, Ecuador, Uruguay, Honduras and El Salvador. Meeting at ICWIPs was fundamental for the establishment of the regional network of women physicists. The deep involvement of women from the region is also reflected in that I was elected Chair of the WG for the period 2011–2014 and Lilia Meza Montes of Puebla, Mexico will be Chair starting in 2021. When Lilia's mandate is over, Latin American physicists will have chaired the Working Group for more than half of its time.

The existence of the IUPAP WG put the issue of Women in Physics on the agenda of many Latin American countries where it did not exist. Proposals to discuss the subject were met with skepticism at the beginning. People with concerns about the social situation in the region, particularly, on the lack of access to education of

quality for large fractions of the population, considered that reducing gender inequality in science could wait until more urgent problems were solved. It took many years for this attitude to change. At present it is clear that women scientists of developing countries face at least two types of discrimination. They are discriminated because they are women and because they are part of scientific communities that are not as well recognized as those of more established centers. The ideas that diversity contributes to the advancement of science and that an increased participation of women in science can help reduce the inequalities of society at large are now shared by a majority of Latin American scientists.

Going back to the beginning of the 21st century, the momentum gained after the first ICWIP led Marcia Barbosa to organize a similar activity at the Latin American level. Taking into account that the physics community is not that large in the region, she decided to include researchers of other STEM disciplines. The First Conference of Latin American Women in Exact and Life Sciences was then organized in Rio de Janeiro, Brazil, in 2004. It was attended by about 100 participants from Brazil (80), Cuba (3), Mexico (3), Argentina (2), Peru (1) and other countries (10), most of whom were physicists (32). There were also researchers in biology (22), humanities (8), mathematics (7), chemistry (2), economics (1), engineering (1) and other disciplines (29). The structure of the conference was similar to that of the first ICWIP with plenary talks, presentation of posters by country and parallel break-out sessions. There were also round-tables. The second conference of this type took place in Mexico in 2006 and was co-organized by the National Autonomous Universities of Mexico (UNAM) and of Puebla (BUAP) and the Center for Optics Research of León (CIO). The third conference took place in Bolivia in 2008 and the fourth in Guatemala in 2009. After that date, the conferences were discontinued. However, their underlying network of contacts was kept alive.

The success of the training activities for early career physicists of the various ICWIPs inspired its Latin American participants to organize them in the region. The first problems that we encountered were the lack of suitable funding sources and the skepticism with which authorities of scientific institutions often looked at this type of initiatives. The potential organizers were physicists who did research in physics and the themes of the training workshops were outside the scope of their research projects. A way around this problem was eventually found by organizing a scientific meeting that included discussion sessions on the difficulties encountered by participants to advance in their careers. The meeting was a school for graduate students from all the Americas on the subject of nano-science and biological physics that was supported by the Pan American Advanced Studies Institute (PASI) of the US National Science Foundation. It took place in Puerto Rico in 2010 and had equal participation of women and men. In 2013 the former member of the IUPAP WG on WIP, Shobhana Narasimhan of India, organized the first Career Development Workshop for women physicists at the Abdus Salam International Centre for Theoretical Physics of Trieste, Italy. The workshop, which has been organized regularly ever since, is intended for people from all developing countries. A Latin American participant of its first edition, however, felt that it was slightly alien to her needs and culture. Among others, language barriers were a problem. This stimulated Lilia Meza Montes to propose the organization of a Latin American Career Development Workshop to the National Council of Science and Technology of Mexico (CONACyT). CONACyT suggested the inclusion of other disciplines besides physics with under-representation of women. Thus, the First Workshop on Professional Skills for Young Women Scientists was organized in Puebla, Mexico, in July 2014, by Lilia, Alba Ávila from Bogotá, Colombia and myself [17]. About 60 students and early career scientists of physics, mathematics and engineering, mainly from Mexico and Central America, participated in the workshop. Social scientists specialized in feminist epistemology and psychologists were among the invited speakers or activity coordinators. The workshop gave rise to an intense trans and interdisciplinary exchange that contributed to the formation of the Network of Science, Technology and Gender (former Red MexCyTeG), which was established in 2014. The network has been very active producing a lot of valuable documentation and organizing workshops in Mexico and has several members of other Latin American countries, besides Mexico.

Workshops on Professional Skills with a Gender Perspective were subsequently organized in Buenos Aires, Argentina, in 2016; in Bogotá, Colombia, in 2017; in Lima, Peru, in 2018; in São Paulo, Brazil, in 2019 and hopefully will take place in Santiago, Chile, in 2021 after its postponement due to the Covid pandemic. Starting with the Argentinian editions people of all genders and from all STEM fields were invited to participate. The

workshops have plenary talks by established scientists of STEM fields and researchers of gender in science, round-tables with ample participation, break-out sessions to discuss gender-related problems, career development training sessions, activities to raise awareness on gender bias and discrimination and scientific poster sessions. Information on funding sources for collaborative projects across the region are also provided. The themes slightly change depending on the country. In Brazil, for example, a round-table on racial discrimination was organized within the workshop. As in the case of ICWIPs, the atmosphere of the workshops is very special allowing participants to share intimate feelings and experiences, in the words of a student they have “a great emotional openness.” This led to a discussion during the first workshop as to whether it would be good to allow the participation of men. The experience of the subsequent editions, in which men were a minority among participants, has been good in this respect. Another interesting outcome of the workshops is that what was supposed to be an activity to “empower” young women scientists turned out to be a source of knowledge and wisdom for us, the more “established” ones. We now see the workshops as a place for a very fruitful dialogue among generations, disciplines and genders. A satisfaction survey is always run after the workshops. The results so far have been very positive. Some of the testimonies of the participants have been collected in the book we have referred to before [8].

The latest editions of the workshops were organized back to back with activities related to the Gender Gap in Science project. Namely, as described before, from its very beginning the project was interested in incorporating the vision of people from developing countries. The Regional Latin American Workshop of the Gender Gap in Science project in which the questionnaire for the Global Survey of Scientists was analyzed was organized immediately after the Workshop on Professional Skills for Young Scientists in 2017. This allowed a wide dissemination of information on the project. It was also key for the large number of survey responses from Latin American countries which doubled the number we had previously expected. The Bogota Workshops took place soon after the beginning of the “Not a single less” movement against gender violence that started in Argentina in 2015 and was then replicated in other Latin American countries. This movement raised awareness on gender-related problems and was key for the advancement of the agenda of women and gender diversity in the region, including the Gender Gap in Science project. The enthusiasm of the participants is reflected in that we now have a Latin American Chapter of the Gender Gap in Science project with a website (see Table 1) and a book co-edited by Lilia and myself with contributions by the participants of the Bogotá workshop which was published in 2019 by the Mexican Physical Society [8]. This Latin American Chapter made possible the organization of the workshops in Lima, São Paulo and the future one in Santiago, Chile.

Inspired by the Gender Gap in Science project, the Latin American chapter also collected information on good practice initiatives in the region and outside, making it available on its website. The initiatives can serve as inspiration for the development of new policies across countries. It can be noticed that many of the initiatives in the region are aimed at handling and preventing gender violence. In fact, this is a pervasive problem in Latin America, the region with “the highest rate of non-couples related sexual violence in the world and the second highest rate of violence by partners or ex-partners,” according to an UN report [18]. Sadly, the academic and scientific communities are not exempt from suffering it. That is why many institutions of higher education and scientific research in the region have approved protocols to handle cases of gender violence and discrimination. As mentioned before, these protocols resulted in a better workplace environment for all.

Conclusions

The IUPAP strongly believes that diversity contributes to excellence in science and that the full participation of people of all genders and ethnic and cultural backgrounds in the physics and scientific communities is absolutely necessary. The IUPAP also considers that all people are equally good in doing excellent science and deserve equal opportunity, not only for the advancement of science but also as a basic human right. The IUPAP has long ago assumed the responsibility of promoting actions within the international physics community and of defining policies with impact on its own structure and activities to increase the participation and recognition of women in physics. Information on the IUPAP actions could be shared with representatives of other scientific

unions within the framework of the Gender Gap in Science project, something that might result in the design of new initiatives beyond the realms of physics. The very active network of women physicists that grew out of the IUPAP initiatives exerted a strong influence to put the issue of gender diversity in physics and science on the agenda of many countries and regions. This was particularly the case in Latin America. In this paper we have covered all these aspects, presenting a brief account of the main activities and achievements that occurred over the past 20 years. We finalize the paper with a list of useful links in Table 1. The main message I would like to convey is that it is important to learn from one another, across disciplines, genders and generations. Advancing in this regard will make us better human beings and, in doing so, it will lead to better science.

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