The Institute of Physics is a leading scientific membership society working to advance physics for the benefit of all. We have a worldwide membership and our purpose is to gather, inspire, guide, represent and celebrate all who have a passion for physics.

As physics is an international endeavour, we work to foster international collaborations, both to expand the boundaries of knowledge and to solve global challenges. We, as an organisation, and our partners, provide opportunities to people in low- to middle-income countries that may benefit from training in physics and other related areas.

We seek to promote physics around the world and partner with like-minded organisations to demonstrate the value and versatility of physics. This annual review will outline IOP international activities from 2017 and, for this edition only, detail our approach for the year ahead.

Cover image: Dr Askwar Hilonga (business mentor) helping students with their group projects
CAPACITY BUILDING

From science to business: supporting STEM entrepreneurs

The connection between science and business has the potential to create change in individuals, communities and entire countries. It is this belief, coupled with an aim to inspire the next generation of STEM entrepreneurs around the world, that forms the foundation for the IOP’s international capacity building work in support of STEM-based business.

Over the course of 2017 the IOP has shifted its focus to the creation of a comprehensive strategic approach that will support STEM entrepreneurs globally. The programme has been designed to support scientists and engineers who want to explore the possibility of commercialising their ideas or inventions. When moving into the commercial world all new start-ups need to acquire a set of requisite skills. However, learning to develop such skills is not always included in formal education routes. The IOP and its partners provide an environment where those skills can develop.

Future STEM Business Leaders

The Future STEM Business Leaders programme is the IOP’s flagship programme in Tanzania. It has been developed in partnership with the University of Dar es Salaam, with support from international partners, to build entrepreneurial skills amongst secondary school students in Dar es Salaam. The reality is that many students in Tanzania will not attend university and therefore could miss out on opportunities to explore alternative avenues for their future. This programme combines the importance of teaching physics in a practical way, whilst exploring the significant connection between science and business. We work with both private and government schools in Dar es Salaam over a period of eight months to enhance their business knowledge. Each school is assigned a business mentor and given the opportunity to work with incubators in Tanzania to help develop their ideas into a business.
Online resources

When the goal is to reach large numbers of people (in our case, entrepreneurs) there is no better way than through the use of online resources. Over the course of 2017 we have been working with experts in the UK to create and deliver a series of webinars to help support entrepreneurs in the areas that they find most difficult. In the 10 years that the IOP has worked with aspiring entrepreneurs it has become clear that creating marketing for start-ups, business financials, intellectual property and patenting are by far the most challenging areas for aspiring entrepreneurs. Our webinars help with these areas specifically and are freely available to everyone who is interested in participating.

Entrepreneurship training courses

We run entrepreneurship courses in partnership with several leading international organisations to provide hands-on training for aspiring entrepreneurs. Our partners include the American Physical Society (APS), the Optical Society, and the International Centre for Theoretical Physics, amongst others. The training runs over a period of five days and creates a hypothetical learning experience for those who wish to learn more about the commercialisation of scientific ideas. The training gives participants the opportunity to learn new skills and network but also practise the nuances of pitching through developing a group project. The training culminates in a competition where participants work in teams to deliver a pitch to a panel of judges. While the training is an introduction to the concept of entrepreneurship and the possibilities it holds, it does provide a foundation that participants can build on in the future. Participants are encouraged to engage in other IOP activities to cement and increase their knowledge.
The Dar Teknohama Business Incubator in Dar es Salaam providing advice to young STEM entrepreneurs.

Participants during a networking session at entrepreneurship training in Sao Paulo, delivered in partnership with the International Centre of Theoretical Physics – South American Institute for Fundamental Research (ICTP-SAIFR). Photographer: Lucas Sanches.
Our plan for 2018

**STEM business mentors**
The STEM business mentors initiative has been designed to harness the experience and knowledge of entrepreneurs and ensure that it is filtered down to those who aspire to commercialise their ideas. Mentors run a maximum of five sessions annually with locations ranging from secondary schools to universities. They cover a range of subjects from communication skills to business models, as well as drawing on their own experiences of conducting business in their country.

**Hatching minds through in-country support**
When running international projects it is important that organisations utilise local knowledge, and this is exactly what the IOP is doing through the hatching minds aspect of the entrepreneurship programme. In this space we work with in-country incubators and entrepreneurship centres to help individual entrepreneurs bring their ideas to fruition. Throughout 2017 we began this process by working with the Dar Teknohama Business Incubator in Dar es Salaam to support the students who are part of the Future STEM Business Leaders Programme, and the entrepreneurship centre within Universidad Iberoamericana as part of our work in Mexico. We are very proud to work with these institutions and will continue to do so over the course of 2018 in support of our strategic priorities.
Teaching practical physics

The versatility of physics is something that should be celebrated; however, the opportunity to explore this is often overshadowed by pre-existing opinions of the subject. The programme we have in Tanzania and South Africa, with in-country partners, looks at this problem and encourages teachers to solve it. Our practical physics teacher training presents a new way of teaching physics by using practical, low-cost experiments that can be replicated in the classroom. The key factor in this programme is that it is low cost and can have a great impact on the ability of teachers to teach and students to learn.

We move focus away from expensive laboratory equipment and towards low-cost experiments where the equipment can be locally sourced.

Young Scientists Tanzania

In support of STEM in Tanzania the IOP is a supporter of the annual Young Scientists Tanzania (YST) competition. We provide funding and support for the silver prize for physics, which this year was awarded to two students from Kijota Secondary School in Dodoma.
Virdee Grant

In support of scientists from low- to middle-income countries, the IOP has set up the Virdee Grant, enabled through a generous donation from Professor Sir Tejinder Virdee. The grant provides funding to IOP members in the UK and Ireland who wish to develop programmes in sub-Saharan Africa.

Profiles of Virdee Grant winners

**Mawazo Institute**

**One goal, public-engagement training, three partners**

The Mawazo Institute, a not-for-profit research institute in Kenya, has a core mission to promote public engagement particularly amongst women, to empower those women in STEM and to educate the public. Volunteers, supported by the Virdee Grant, travelled to Kenya to deliver outreach and engagement training to help reach this goal.

**Yellowbric**

**Ten schools, seven partners, three countries**

Yellowbric uses educational tools and digital media to support the learning experience of students in Ethiopia and South Africa. In support of this goal, Yellowbric ran the School Space Race to encourage students from across the UK, Ethiopia and South Africa to build their own unmanned aircraft using a weather balloon and compete for a once-in-a-lifetime trip to CERN.

**Martina Fonseca**

**Four schools, two weeks, low-cost training**

Martina, a postgraduate physics student at University College London, travelled to Mozambique to provide low-cost computing resources and training to students in four local schools. Martina chose to focus on how light is a versatile, transportable and non-invasive way of probing materials and tissues. Both the schools and Martina benefitted a great deal from this experience.
INTERNATIONAL RELATIONS

International affairs: promoting physics

The promotion of physics is an important endeavour. We look to engage with sister societies, demonstrate the excellent work in physics that is taking place in the UK and Ireland, and support collaborations between international bodies.

IOP international members
The IOP has thousands of members based internationally and a number of initiatives to support and engage our membership around the world.

This includes supporting our overseas membership to strengthen relations with our sister societies, by providing funding and support to enable six or more members based in any given country to apply to form an international chapter. The aim of the initiative is to encourage members to engage with one another and their national physical society but also run a range of activities to advance physics education, research and application in their country. Over the last two years we have piloted this model with members in Finland.

Bilateral awards
The IOP’s annual awards celebrate the best of physics, both to reward researchers for ground-breaking work and to help inspire the next generation of physicists. Several of these are awarded jointly with our partner societies from around the world.

The Born medal and prize
In partnership with the German Physical Society to commemorate Max Born, the prize is awarded for outstanding contributions to physics.

The Holweck medal and prize
In partnership with the French Physical Society in memory of Fernand Holweck, this award is given for distinguished work in any aspect of physics that is ongoing or has been carried out within the 10 years preceding the award.

The Massie medal and prize
In partnership with the Australian Institute of Physics and created in 1988 to mark the 25th anniversary of the founding of the society, this is awarded for contributions to physics or its applications.

The Occhialini medal and prize
In partnership with the Italian Physical Society and developed to honour the memory of Giuseppe Occhialini, the medal is awarded for distinguished work carried out within the 10 years preceding the award.
IOP relationships around the world

There have been some great opportunities for our members and fellows to represent the IOP internationally. Following a call to our fellows, Alexandre Zagoskin from Loughborough University volunteered to represent the IOP at the biennial conference organised by the Polish Physical Society, where he gave a talk on the commercialisation of quantum technologies. Additionally, IOP fellow Adrian Podoleanu from the University of Kent represented the UK and ROI community at the General Assembly for the International Commission for Optics (ICO), where he was elected onto the ICO governing body.

In addition to our members, IOP staff have also attended events in order to build relations. Such events include the opening ceremony of the SESAME facility in Amman where, alongside the APS and others, we support a travel-grant programme for scientists in the Middle East and North Africa. The IOP’s chief executive officer attended the IUPAP General Assembly in Sao Paulo, where new members were elected onto the various commissions. The head of international also attended the launch of the Nuclear Physics European Collaboration Committee’s long-term plan that was unveiled in Brussels and which many of our members were involved in preparing.

CPS delegates visiting the particle-physics laboratory at the University of Oxford.
This year was important for IOP-China relations and we welcomed a delegation from the Chinese Physical Society (CPS). During the visit the CPS toured some of the UK’s major scientific facilities and met with directors of facilities and research programmes throughout the country. The visit was an important step in maintaining and developing potential collaborations between the scientific communities in both the UK and China. This includes forging links between our special-interest groups and the CPS equivalents. Furthermore, we will consider how we can build on this visit by establishing a programme to maintain strategic relations between the two societies.

Other highlights

- Organised two scientific sessions at the American Association for the Advancement of Science meeting, jointly with the Science and Technology Facilities Council and other partners. One of the sessions compared US and European energy technology policies, and the other focused on physics for medicine.

- Submitted successful proposals to the European Physical Society special activity fund to partner with our sister societies throughout Europe to expand three IOP projects: translating our exoplanets resource for Spanish schools, organising a European workshop to discuss our schools physics glossary project, and training early-career IOP members to take on the role of outreach ambassadors.