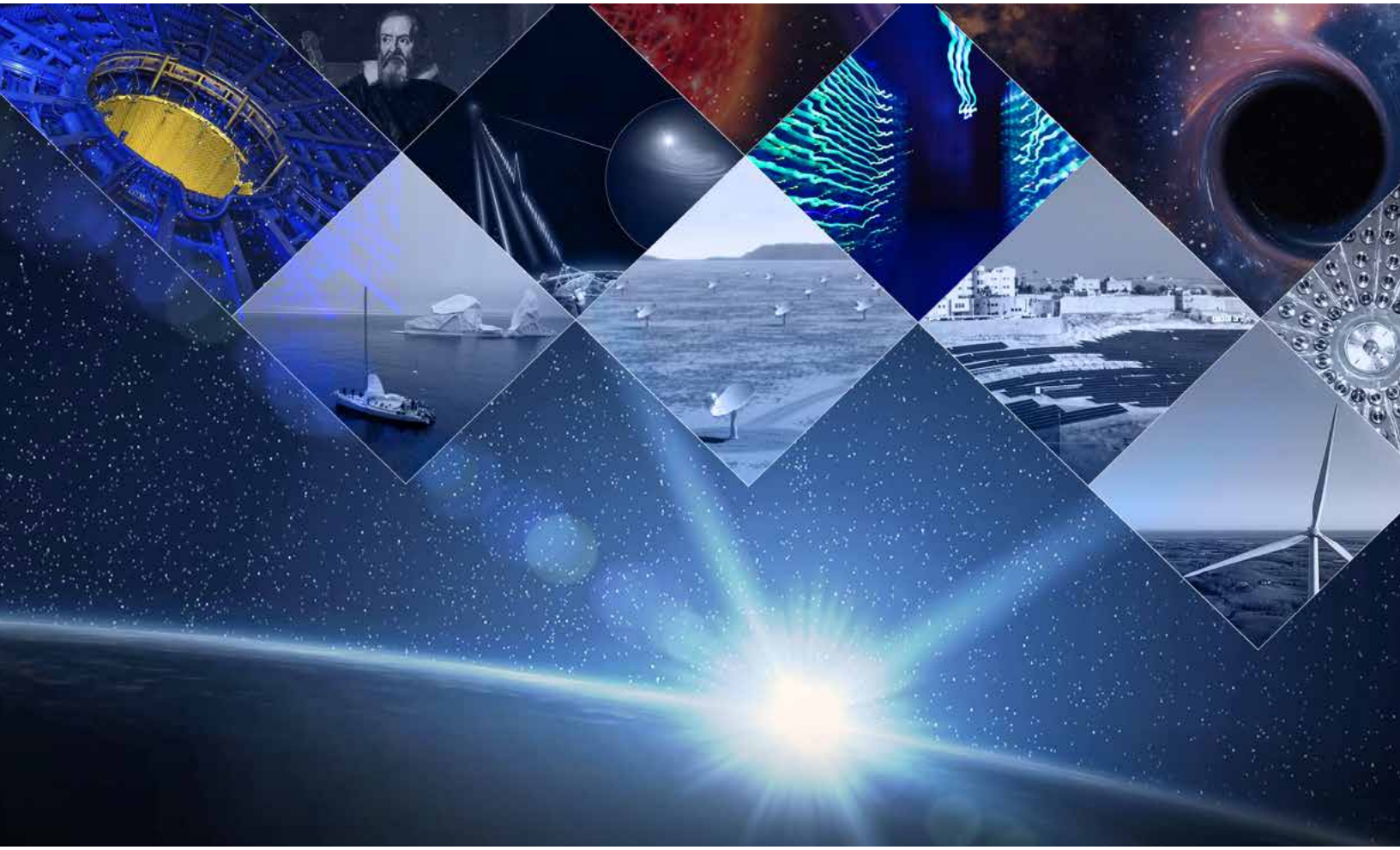
Forum on INTERNATIONAL PHYSICS

Winter 2021 American Physical Society aps.org/units/fip/



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Letter from the FIP Chair 2020

Luisa Cifarelli

Dear FIP Members,

While stepping down as the 2020 Chair of the APS FIP (Forum on International Physics), I would like to briefly recapitulate the activities and projects of the Forum in this special year of COVID pandemic.

The FIP Executive Committee has met twice this year, in April and in October, using Zoom of course. But we are all very familiar now with this kind of remote interactions and discussions, and the Executive Committee has been able to efficiently operate all the same.

The FIP Program Committee, chaired by Alan Hurd (FIP Vice Chair), has been carrying out the organisation of the APS March and April 2021 Meetings. These have soon been transformed into online meetings. Topical FIP sessions have been identified, some of them shared with the Forum on Physics and Society (FPS) and the Forum on Early Career Scientists (FECS). You are all invited to register and follow, joining our large audience of international scientists.

The FIP Fellowship Committee, that I chaired, has selected 5 distinguished candidates out of a list of 11 applicants, who have been approved by the APS. These new APS FIP Fellows are: Susan Scott (University of Canberra, Australia), Steinar Stapnes (University of Oslo, Norway), Panagiotis Spentzouris (Fermilab, USA), Kaixuan Ni (UC San Diego, USA), Carlos Henrique de Brito Cruz (University of Campinas, Brazil).

The Wheatley Award Selection Committee, whose members were: Elena Aprile, Emanuela Barzi, Alan Hurd, Vengu Lakshminarayanan, Joe Niemela, and Federico Rosei (2019 Awardee), has selected two ex aequo recipients of the 2021 John Wheatley Award: Nathan Berkovits (ICTP-SAIFR/IFT-UNESP, Sao Paolo, Brazil) and Fernando Quevedo (University of Cambridge, UK).

The Nominating Committee, chaired by Elena Aprile (FIP Past Chair), has prepared a slate of candidates for the positions of Vice Chair and two Members-at-Large. After the elections, which took place in October, Christine Darve (ESS, Lund, Sweden) is the new FIP Vice Chair, and Tabbetha Dobbins (Rowan University, USA) and Frank Zimmerman (CERN) are the new FIP Members-at-Large. The FIP Executive Committee has also decided to soon update its by-laws in order to formally include an early career physicist among its members as it is the case in many other APS Units.

In 2020 the *leitmotiv* of FIP has been "Physics for Development", in line with the desired international engagement of the APS. To this purpose, a number of things have been done:

- FIP has substantially increased (i.e., more than doubled) its funding contribution to the International Travel Award Program (IRTAP) for the year 2021 to support research collaboration between physicists in developed and developing countries. Notice that this program has been on-hold in 2020 due to the COVID pandemic. Next year, if the pandemic situation will still prevent travels and exchange visits, FIP might envisage to fund some remote collaboration work with the IRTAP grants, for instance providing funds for connectivity equipment (if needed).

- FIP has also increased its funding of the Distinguished Student (DS) program to support overseas students to attend APS meetings, targeting special scientifically emerging regions of the world. In 2020-2021 these are Jordan, Pakistan and North Africa. Due to the pandemic, the DS awardees will be invited to present their work by giving a virtual talk at the March or April Meetings 2021 and their registration fees will be reimbursed. In addition, the awardees will be invited to publish highlights of their talks in this newsletter.

- In line with the announced outreach activities, FIP has completed the first phase of the series: PHYSICS MATTERS – Online colloquia as Physics for Development initiative in COVID times. The main goal of these colloquia as part of the "Physics for Development" strategy of FIP is to support APS international commitment towards students and early career physicists, targeting developing country audiences. The first phase of the PHYSICS MATTERS series has been completed in the fall of 2020, with recorded video colloquia which have been broadcast weekly without registration from the APS FIP web page and Facebook page. The full PHYSICS MATTERS 2020 program can be found in this newsletter and at the link https://engage.aps.org/fip/resources/activities/physics-matters, where the appropriate links to watch the videos still available on YouTube are provided.

- In 2021 FIP plans to continue the PHYSICS MATTERS series including also live online colloquia that will primarily involve some test centers, selected from within the SESAME project partner countries, a well-known project supported by the APS, namely Jordan, Iran and Pakistan. Addressing at first some specific countries in the Middle East, FIP has in mind however to enlarge the audience to as many developing countries as possible. FIP is also eager to take advantage in this outreach program of the future contribution of other APS Forums, in particular: Early Career Scientists (FECS), Graduate Student Affairs (FGSA), Outreach and Engaging the Public (FOEP).

Let me come now to the newly established FIP Outreach & Communication Committee (OCC) which was meant as a task force to improve FIP's visibility through its newsletter, web page and social media, to promote at large its many activities and initiatives, and to find efficient means to campaign for member recruitment at the international level, namely from big international laboratories to various kinds of institutions and centers around the world, including developing countries. To this end the OCC has implemented many of the actions foreseen. In particular, voluntary help has been found for our newsletter graphics and for

the maintenance and update of our web and social media pages. In this respect I would like to thank Carmelo Pellegrino (Italian National Institute of Nuclear Physics), Vitaly Pronskikh (FNAL) and Maninora Sanges (Italian Physical Society). Thanks to Paola Catapano (Head of the CERN Audiovisual Production Service) who joined the FIP OCC, a short (one minute) trailer to promote FIP's international engagement has been produced. It has already been used as an introductory video for the PHYSICS MATTERS colloquia, and it could be used as well for any FIP session at APS Meetings. The trailer is embedded in the FIP web page and also available from the CERN CDS video server.

Finally, let me say how deeply the international community has been troubled by the recent episode of violence happening with the murder of Iran's leading nuclear physicist, Mohsen Fakhrizadeh. FIP strongly supports the APS presidential letter by Philip H. Bucksbaum of December 11, 2020, calling "on all governments to condemn the use of violence against scientists", irrespective of the strategical motivations and/or geopolitical implications of such a use of violence.

At the end of my mandate as FIP Chair, I will not disappear but let me conclude by expressing my warm gratitude to Alan Hurd (FIP Chair Elect), Joe Niemela (Vice Chair), Elena Aprile (Past Chair), and the members of the FIP Executive Committee: Ilham Al-Qaradawi (Member-at-Large), Bill Barletta (Member-at-Large), Dmitri Denisov (Member-at-Large), Emanuela Barzi (Councilor), Carlos Bertulani (Secretary/Treasurer), Vengu Lakshminarayanan (Member-at-Large), Maria Longobardi (Newsletter Editor), Abhishek Kumar (Member-at-Large), and Anne Matsuura (Member-at-Large). My heartfelt thanks go as well to Amy Flatten (APS Director of International Affairs) and to Michele Irwin (APS International Programs Manager), for their wonderful help and support, on a personal level and through the APS Committee on International Scientific Affairs. It has been a privilege and an honor to serve FIP and to work with all of them in this special and unforgettable year 2020.

Luisa Cifarelli

Chair – Forum on International Physics (FIP)
University of Bologna, Italy
E-mail: luisa.cifarelli@unibo.it

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  Join an APS Unit Online
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It's Time to Let the Science Speak

Maria Longobardi

The entire world is still facing unprecedented times in the wake of the coronavirus. At the front lines of this pandemic are experts and scientists urging the public to listen to their recommendations. Now, more than ever, we all recognize the role of science and the importance of fact-based information. It's time to let the science speak. As scientists, our duty is to collect and share knowledge and spread the voice of science.

In February 2020, the World Health Organization (WHO) expressed concern about a global misinformation "infodemic". The proliferation of false information about COVID-19 and science, in general, poses a serious risk to public health.

A recent study published in Nature Human Behavior in February 2021 (Loomba et al. Nat Hum Behav, 2021 https://doi.org/10.1038/s41562-021-01056-1) reveals that as of September 2020, in both the UK and the USA, fewer people (54.1% and 42.5%, respectively) would definitely take a vaccine than is required for herd immunity. The spread of misinformation could push these levels further away from immunity targets.

Another study from the University of Cambridge, UK, published in October 2020 by the Royal Society (Jon Roozenbeek et al. R. Soc. Open Sci. 7: 201199 https://doi.org/10.1098/rsos.201199) investigates susceptibility to coronavirus-related misinformation and its influence on health-related behaviors in large national surveys (UK, USA, Spain, Ireland and Mexico). They find that higher trust in scientists and having higher numeracy skills were associated with lower susceptibility misinformation.

The research underlines the crucial role that scientists play as disseminators of factual and reliable information and the potential importance of fostering critical thinking skills to reduce susceptibility to misinformation.

Sharing our scientific work and expertise, and engaging with the public, is an important part of being a scientist now. By countering misinformation about COVID-19, scientists can help policymakers avoid introducing harmful policies, improve public understanding of the pandemic and, most importantly, save lives.

The FIP recognizes the key importance of raising the voice of science and sharing knowledge. We would also like to hear from you, our FIP members, and the whole APS community about your experiences and suggestions on how we can serve better and combat misinformation.

There are still many unanswered questions in light of the coronavirus pandemic. FIP members will continue to work tirelessly to find answers to these questions, share critical information, and tell our community members' stories.

FIP Newsletter will continue to provide the vital information and news that our international community deserves.

As a Newsletter Editor, I want to thank the Newsletter Committee 2020 for the precious help: Amy Flatten (APS), Christine Darve (European Spallation Source), Kanudha Sharda (Elsevier), Jim Gubernatis (LANL, retired) and Emanuela Barzi (Fermilab).

If you have any comments, questions or feedback, please email me at marialongobardi@gmail.com

Sincerely,

Maria Longobardi
FIP Newsletter Editor

2020 PHYSICS MATTERS

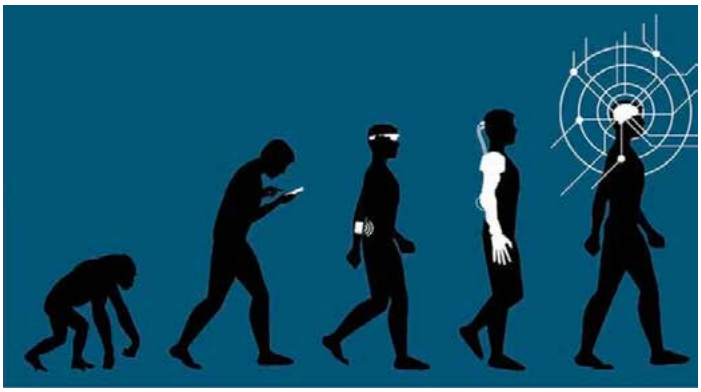
Online colloquia as Physics for Development initiative in COVID times

23 November 2020

Paola Catapano
(CERN, Geneva Switzerland – Head of the Audiovisual Production Service for the CERN Communications Group and Project Leader of Polarquest)

Luisa Cifarelli
(University of Bologna, Italy – FIP Chair and past President of the Centro Fermi, Rome, Italy)

POLARQUEST – A sailing expedition to measure cosmic rays (and not only) beyond the Arctic Circle



14 December 2020

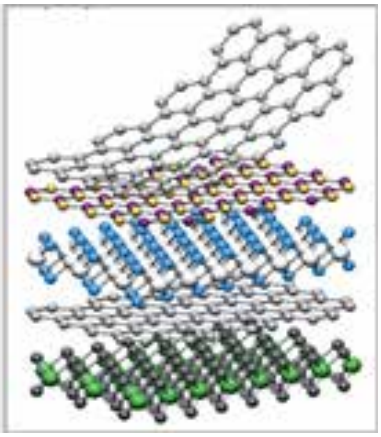
Sergio Bertolucci
(University of Bologna, Italy – Past CERN Director of Research and Scientific Computing, Geneva, Switzerland)

Governing the digital transformation

30 November 2020

Diederik Wiersma
(University of Florence, Italy – President of the Italian Metrology Institute, Turin, Italy)

Metrology and inspiration for science: The new International System of Units



7 December 2020

Petra Rudolf
(University of Groningen, The Netherlands – President of the European Physical Society)

Playing Lego with layered materials

21 December 2020

Patrizia Tavella
(Bureau International des Poids et Mesures, Sèvres, France – Director of the Time Department)

The adventure of physics in timing and positioning – From a cesium atom to the Global Navigation Satellite Systems

News from the FIP

Welcome to our new FIP Executive Committee Members.

Christine Darve
European Spallation Source
Chair elect (02/21–12/21)

Frank Zimmerman
CERN
Member-at-Large (02/21–12/23)

Tabbetha A Dobbins
Rowan University
Member-at-Large (02/21–12/23)

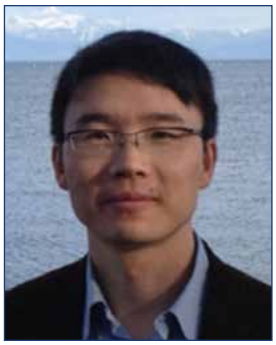
FIP Honors and Awards

2020 FIP APS Fellowship

APS Fellowship is a distinct honor signifying recognition by one's professional peers. The criterion for election is exceptional contributions to the physics enterprise. The FIP APS Fellowships are nominated by FIP

Carlos Henrique de Brito Cruz
Physics Institute, University of Campinas (Unicamp), Brazil

Citation: For fundamental research in ultrafast laser development leading to seminal understanding of chemical transitions in semiconductors and biomolecules, and for trailblazing in the international physics community by fostering collaborations, education, and science diplomacy.



Kaixuan Ni
University of California San Diego

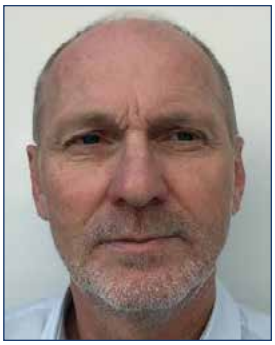
Citation: For pioneering contributions to the development of liquid xenon detector technologies for dark matter search, for tirelessly promoting international collaboration in particle astrophysics, and for mentoring US and international students.

Susan M Scott
The Australian National University

Citation: For groundbreaking discoveries in general relativity and gravitational wave science, advancing our understanding of the singularities and global structure of space-time and the nature of astrophysical signatures in gravitational wave experiments; and for promoting gravitational research worldwide.

Panagiotis Spentzouris
Fermilab

Citation: For achievements in high energy physics with emphasis on scientific computation for international collaborations, and for fostering international partnerships in quantum computing and quantum information science and technology.



Steinar Stapnes
CERN

Citation: For promotion and scientific leadership of truly global collaborations at the frontier of linear colliders for particle physics research.

2021 John Wheatley Award

The John Wheatley award recognizes physicists who, working in developing country, have made an outstanding contribution to the development of physics in that region by working with local physicists in physics research or teaching.

Ex-aequo
Nathan Berkovits
(ICTP-SAIFR/IFT-UNESP)

Citation: "For exceptional leadership in fundamental physics research in South America."

Nathan Berkovits received his BA and MA in Physics from Harvard University in 1983, and his PhD in Physics from the University of California at Berkeley in 1988 under the supervision of Stanley Mandelstam. He moved to Brazil in 1994 and is a full professor at the Instituto de Física Teórica of São Paulo State University (IFT-UNESP). Since 2011, he has been Director of the ICTP South American Institute for Fundamental Research (ICTP-SAIFR) which is a regional center for theoretical physics and a partner institute of the Abdus Salam ICTP in Trieste. In addition to organizing workshops for researchers, ICTP-SAIFR organizes international schools and minicourses for PhD students as well as outreach programs for high-school teachers and students and the general public. Berkovits' research has focused on the role of supersymmetry in string theory, and the "pure spinor" formalism he developed is the unique formalism for the superstring which can be covariantly quantized. He received the 2009 TWAS Physics Prize for his research, and is a full member of The World Academy of Science (TWAS) and the Brazilian and São Paulo Academies of Science.

(Credit : entre cultura)

Ex-aequo
Fernando Quevedo
Department of Applied Mathematics and Theoretical Physics, University of Cambridge, UK

Citation: "For sustained commitment and achievement in the advancement of physics and science in developing countries."
Fernando Quevedo is a Guatemalan theoretical high energy physicist. He holds a Professorship in Theoretical Physics at the University of Cambridge, UK and a Fellow of Gonville and Caius College since 2001. From 2009 to 2019 he was the Director of ICTP (Abdus Salam International Centre for Theoretical Physics) in Trieste, Italy. He obtained his PhD at the University of Texas under the supervision of Steven Weinberg. His research has been mostly focused on formal, phenomenological and cosmological aspects of field and string theories. He has given hundreds of seminars and colloquia in more than 50 countries. He has more than 150 publications with more than 16,000 citations and an h-index equal to 72. During his mandate ICTP expanded its horizons by creating new institutes worldwide such as ICTP-SAIFR in Brazil and EAIFR in Rwanda, new research areas such as Quantitative Life Sciences and Renewable Energies, new educational programmes such as the International Master in Medical Physics and new outreach projects such as Physics Without Frontiers. He was the founding international coordinator of the network of Guatemalan scientists from 2005 to 2017. He has numerous awards such as the 1998 ICTP prize, a John Simon Guggenheim Fellowship, a Royal Society Wolfson award, the Abdus Salam Medal of the World Academy of Science (TWAS), the Spirit of Salam award and honorary degrees from the Universities San Carlos and del Valle of Guatemala and the University of Chiapas in Mexico.

The Square Kilometre Array Observatory (SKAO)

Justin Leonard Jonas

The Square Kilometre Array Observatory (SKAO), an international treaty organization that will oversee the construction and operation of the SKA radio telescopes in Australia and South Africa, is on the verge of coming into being, with five countries having ratified the treaty to date. More ratifications, and associated funding commitments, are expected over the coming months. The SKAO headquarters are located at Jodrell Bank in the UK, adjacent to the iconic Lovell telescope. The low-frequency telescope (SKA-low) consisting of approximately 130,000 dipole antennas is to be installed in Western Australia, and the mid-frequency telescope (SKA-mid) consisting of 197 dishes is to be built on the central Karoo plateau of the Northern Cape province in South Africa.

The science case for the SKA observatory as been refined over the past three decades by international working groups, and much of the engineering design and prototyping has been completed by collaborative consortia managed and supported by countries that are members of the SKA Organization, the predecessor of the SKA Observatory. South African scientists and engineers have played a significant role in both the development of the SKA science case and the preliminary engineering work. Construction of the first phase (SKA1) of the two telescopes is expected to commence once the council of the nascent SKA Observatory has approved the construction proposal, and funding has been secured from the member countries.

A broad science objective that motivated early SKA discussions was to use the 1420 MHz atomic hydrogen (HI) line to explore the evolution of the universe and its constituent galaxies out to high redshifts. This objective defined specifications for the sensitivity, resolution and frequency coverage for the SKA. The detection and mapping of the hydrogen emission from high redshift galaxies requires an increase in antenna collecting area in excess of an order of magnitude over existing facilities. Unsurprisingly, further science cases that benefit from the unprecedented sensitivity were identified, and the SKA developed from a "hydrogen array" into a general-purpose facility that would service a wide range of astrophysics, cosmology and fundamental physics investigations. The wide-ranging science case for SKA1 and its future extensions is codified as a compendium of papers prepared by an inclusive collective if scientists (SKAO, 2015). High priority areas of science include the detection and characterization of the atomic hydrogen signature caused by the formation of the first stars and galaxies (Cosmic Dawn and Epoch of Reionization), radio pulsars (tests of general relativity and the equation of state of neutron stars), HI spectral line and continuum surveys of galaxies (star formation and galaxy evolution, dark matter and dark energy), cosmic magnetism, and the detection of proto-planets.

In the meantime, the MeerKAT radio telescope (Jonas et al., 2016), built and operated by the South African Radio Astronomy Observatory (SARAO) at the central Karoo observatory site that will also host the SKA-mid, has been running successfully since its inauguration in 2018. The MeerKAT is designated as an SKA precursor, indicating that it has provided a technical prototyping platform for SKA-mid, and that it is an SKA science pathfinder, providing early observational results that will refine the science case and planning for the SKA. MeerKAT will be incorporated into the SKA-mid telescope towards the end of the construction of SKA-mid, so the final amalgamated telescope will consist of 64 MeerKAT antennas and 133 SKA antennas. The SKA antennas will be very similar to the MeerKAT counterparts, but are larger (15-metre diameter) and have a slightly modified optical configuration.

Early commissioning observations made by MeerKAT have already yielded novel scientific results, some of which are summarised below.

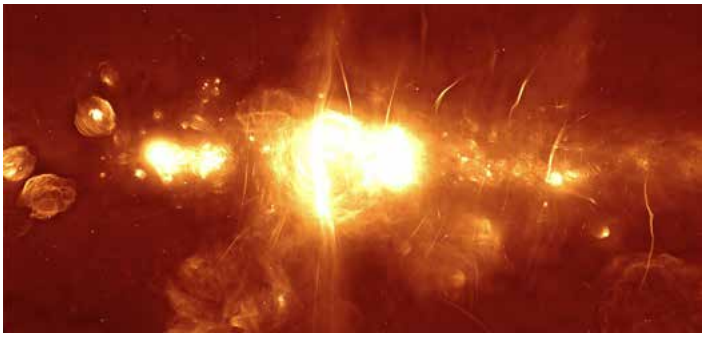
- While observing the central region of the Milky Way, the observers identified filamentary emission structures that extended above and below the Galactic plane. Extending the area of observation revealed large bipolar radio bubbles extending out of the central regions of our galaxy (Heywood et al., 2019). The origin of the bubbles is unknown, but they point to energetic outbursts in the Galactic centre region.

- MeerKAT has captured the deepest L-band radio image ever made by pointing at a "quiet" 1 square-degree patch of sky for 155 hours (Mauch et al., 2020). The resulting radio image contained 17,000 radio galaxies, providing a census of about 90% of all of the star forming galaxies in the one-degree cone of the MeerKAT primary beam.

- A number of serendipitous detections of radio sources with complex morphologies have made while observing a sample of galaxy, including X-shaped radio galaxies. Follow-up observations allowed the elucidation of the complex hydrodynamics associated with this object (Cotton et al., 2020).

This sample of early published work highlights the unique qualities of the MeerKAT telescope. The offset Gregorian optical con-

SKA dish prototype antenna, provided by the Max Planck Institute for Radio Astronomy, being tested at the Karoo observatory site (adjacent to the MeerKAT array).



The radio image of the central region of the Milky Way that was one of the first targets for MeerKAT commissioning observations.

figuration of the 64 13.5-metre diameter dishes and the highly optimized, cryogenically cooled receivers that are matched to the optics have produced an instrument with unrivalled sensitivity. The configuration of the 64-element interferometric array has a concentrated core with the majority of the antennas contained within a 1 km diameter circle. The distance between the outermost two antennas is about 8 km. These characteristics of the telescope make it the premier instrument for imaging faint, extended emission (e.g. Galactic bubbles and X-shaped radio galaxies) and faint emission from unresolved point sources (e.g. star-forming galaxies).

These early results do not represent the key science drivers for the MeerKAT telescope, but are instead opportunistic and serendipitous outcomes from commissioning observations that were designed to test the performance limits of the telescope.

The key science topics for MeerKAT were determined by inviting the international astronomy community to propose large survey projects (LSPs) that would require in excess of 5000 hours of MeerKAT observing time. A call for proposals was issued in 2009, with a return date of March 2010. At that time MeerKAT was still in the concept review phase, and so the call provided a "strawman" reference design with goal specifications that allowed respondents to prepare their proposals. The reference design was based on the requirements derived from a prioritised subset of SKA science topics, specifically deep HI surveys, radio pulsars and transients and cosmic magnetism, thereby fulfilling the requirements of an SKA science precursor instrument.

Proposals were received from 20 international consortia that had self-organised to prepare coordinated responses. A review panel selected 11 of these proposals, and two of them were merged into one. Because MeerKAT does not have the X-band receiver that was specified in the call, two of the proposals that required that facility were subsequently dropped from the list of MeerKAT LSPs.

The 8 MeerKAT LSPs are:

- LADUMA: an ultra-deep extragalactic HI survey to investigate the evolution of galaxies and their star formation rate
- MHONGOOSE: deep HI observations of a representative sample of nearby galaxies to study the dynamics and distribution of gas
- MIGHTEE: a tiered radio continuum survey to investigate the evolution of active galactic nuclei (AGN), star-forming galaxies and clusters throughout cosmic time
- MeerTIME: timing of radio pulsars to test general relativity and probe the internal structure of neutron stars
- TRAPUM: a search for radio pulsars and fast transients
- ThunderKAT: a search for slow radio transients associated with black holes and other high-energy environments
- MALS: HI and OH absorption line survey to star formation in high-redshif tgalaxies
- Fornax: HI observations of the Fornax galaxy cluster to study gas dynamics and structure formation

Because the as-built MeerKAT telescope exceeded the sensitivity of the reference design provided in the LSP call document by a factor of two and did not have X-band capability, the MeerKAT LSP proposals were updated to reflect the capabilities of the real instrument. Descriptions of the updated LSPs and other MeerKAT science objectives have been captured in a published conference proceedings (Taylor, et al., 2016).

All of the telescope functionality needed to perform these LSP observations has now been implemented and commissioned, and observations are underway or planned for scheduling. Extensive commissioning tests have been necessary to ensure that the telescope is performing correctly before committing thousands of hours of telescope time to the projects.

While science commissioning was underway, calls were issued for smaller "open time" observation proposals that could make use of the telescope capabilities availability at the time. These calls, together with the allocation of Directors Discretionary Time, have provided an opportunity for young South African scientists to obtain access to a world-class facility and gain experience in the reduction, analysis and scientific interpretation of radio astronomy data.

The volume of the raw interferometric visibility data produced during an imaging observation is measured in terabytes, and is therefore a challenge to transfer to the user, and for the user to process into an image. An important component of the telescope that has recently been commissioned is an automated imaging pipeline that provides the observer with a calibrated image within near real-time. Processing is performed at the telescope using a GPU cluster with a single-precision processing capacity of 1.1 petaflops. Raw visibilities are available to users who have the capability to handle the data volume and apply custom processing to the data.

A feature of the MeerKAT telescope architecture is that is was designed from the outset to have "data spigots" that allow relatively easy interfacing to user-supplied digital back-end equipment. MeerKAT is a fully digital telescope, with the received radio frequency signals being digitized directly at the 64 antennas, and all subsequent signal processing is done in the digital domain. The MeerKAT digital signal processing architecture is based on the CASPER concept of bespoke and commodity processor nodes interconnected using commodity Ethernet data switches (Hickish, 2016). This feature, together with the performance characteristics of the telescope, has made MeerKAT a popular host for use-supplied digital backends, some of which are associated with the LSPs. The following user supplied equipment (USE) is currently installed on MeerKAT:

An aerial view of the antennas in the central core of the MeerKAT array.

- TUSE: time-domain transient processor, provided by Manchester University, funded through a European Research Council (ERC) grant
- FBFUSE and APSUSE: beamformer and accelerated pulsar search engine, provided by Max Planck Institute for Radio Astronomy (MPIfR)
- PTUSE: pulsar timing processor, provided by Swinburne University
- BLUSE: search for extra-terrestrial intelligence (SETI) processor, provided by the Breakthrough Listen, a Breakthrough Initiatives program

In addition to the USE backend provided by MPIfR, the institute is also providing S-band receivers for the 64 MeerKAT antennas, primarily for observing radio pulsars. MPIfR scientists have some priority use of these receivers, but they are also available to the rest of the community as facility equipment.

A project to extent MeerKAT with the addition of 20 antennas and ancillary instrumentation has recently been launched. This project is a joint venture between MPIfR and SARAO, with MPIfR providing the dishes and S-band receivers, and SARAO providing the infrastructure and L-band receivers. The dishes and L-band receivers are of the design to be used for SKA-mid, and are therefore an early realisation of the SKA. The additional antennas will be deployed in the outer regions of the array in order to improve the imaging resolution of the extended telescope. Science proposals for this extended version or MeerKAT are currently being prepared, with South African and German scientists having priority on available observing time.

The past two decades have seen an enormous growth in radio astronomy in South Africa, and also in African partner countries that will eventually host SKA antenna stations. In 2000 there were about 10 qualified scientists and engineers associated with radio astronomy in Africa, and now that number is several hundred. The SKA and MeerKAT have been the incentive for this growth, but to enable this growth and provide sustainability, SARAO has run a Human Capital Development (HCD) program that has provided support for scientists, engineers and technicians at all levels, from undergraduate students through to Research Chairs.

This growth of radio astronomy in South Africa is set to continue with the imminent expansion of the MeerKAT, the construction of SKA-mid, and also the addition of the HERA and HIRAX arrays to the Karoo family of radio telescopes. The vision for a hub of ground-based astronomy facilities in Southern Africa has been achieved.

Endnotes

1 Jonas, J.L., *et al.* (2016), PoS **277**, 1.

2 Heywood, I., *et al.* (2019), Nature **573**, 235.

3 Mauch, T., *et al.* (2020), ApJ **888**, 61.

4 Cotton, W.D., *et al.* (2020), MNRAS **495**, 1271.

5 SKAO (2015), "Advancing Astrophysics with the Square Kilometre Array", www.skatelescope.org/books.

6 Taylor, A.R., Camilo, F., Leeuw, L., & Moodley, K. (eds.) (2016), "MeerKAT Science: On the Pathway to the SKA", https://pos.sissa.it/277/

7 Hickish, J., *et al.* (2016), JAI **5**, arXiv:1611.01826

Justin Jonas was born in London and emigrated to South Africa with his parents in 1965. He attended school in Uitenhage, matriculating from Muir College in 1975, and enrolled at Rhodes University for a BSc degree in 1976. All of his tertiary degrees were obtained from Rhodes University, culminating in a PhD in Radio Astronomy in 1999. His PhD topic was the Rhodes/HartRAO 2.3 GHz radio continuum survey of the Milky Way.

He has worked in the Department of Physics and Electronics at Rhodes University since 1981, starting as a research technician and progressing through the researcher and lecturer ranks, and was appointed as Professor of Physics and Electronics in 2001. From 2003 till 2006 he was seconded to be the Managing Director of the Hartebeesthoek Radio Astronomy Observatory (HartRAO), a post he again held temporarily during 2017/2018. He is currently the Chief Technologist for the South African Radio Astronomy Observatory (SARAO), which is a joint appointment with Rhodes University. At Rhodes is the Director of the Centre for Radio Astronomy Techniques and Technologies (RATT). He is the recipient of the 2019 Rhodes University Vice Chancellor's Distinguished Achievement Award.

He has been closely associated with the international Square Kilometre Array (SKA) project since 2001, and was the technical lead for the SKA South Africa team from 2003 until the formation of SARAO. He was responsible for the technical aspects of Africa's proposal to host the SKA, has been intimately involved in the design and construction of the MeerKAT radio telescope, and sits on the Science and Engineering Advisory Committee (SEAC) of the SKA Organization.

He has recently acted as technical advisor to the National Ventilator Project (NVP), an intervention by the South African government to manufacture respiratory support devices to respond to the emergency need created by the Covid-19 pandemic.

Africa, Physics in Africa, and the *African Physics Newsletter*

James E. Gubernatis

Subscription to the African Physics Newsletter is free and open to both Africans and non-Africans. To subscribe go to this website.

We encourage you to forward this newsletter to colleagues interested in the latest developments in physics in Africa.

Voices from African Students in COVID

Patrick Ning'i
Technical University of Kenya, Nairobi, Kenya

My name is **Patrick Ning'i**, a final year student of Bachelor of Technology in Technical and Applied Physics at the Technical University of Kenya. During this lock-down period, I have been doing several things. To start with, I have used this period to finish up my final undergraduate project titled "The Interplay of Lattice Distortion and Bands Near the Fermi Level in ATiO3 (A=Ca, Sr, Ba)." I expect to present my work in an upcoming virtual conference that will be held in August.

Having worked with the SIESTA *ab initio* code for a year now, I have also spent some considerable time tutoring junior students on how to use the system to investigate materials properties such as thermoelectricity as exhibited by compounds such as ScF3. When required, I also make tutorials on how to use various extensional tools that are involved in the materials modeling and investigation process, using standard open source plotting software.

Apart from focusing on my degree work, I have also been actively engaged in several machine learning and data science projects since these are also my areas of interest. I have collaboratively worked on a Market Segmentation project using machine learning, as well as a Twitter Emotional Tracker using Natural Language Processing.

I am currently thinking of how natural language processing can be used to support research in the field of Materials Science. One approach that I have thought of is to create a customized word embedding model using text data, for different Materials Science research articles. This idea has already been implemented. Nevertheless, I believe that replicating it would be an important step towards coming up with a similar model with enhanced capabilities.

Sr. Mary Taabu Simiyu
University of Nairobi, Kenya

Sr. Mary Taabu Simiyu (M.Sc. Physics) is a Roman Catholic nun from the congregation of the Handmaids of the Holy Child Jesus and a Ph.D. student in Condensed Matter Physics at the University of Nairobi, Kenya. She is an award winner of the 3 Minute Thesis competition at the University of Ghana in 2019, and of the Entrepreneurship and Oral presentations at the Nelson Mandela African Institution of Science and Technology in 2015.

She has had a passion for serving the poor since childhood and believes her project in water quality will help low-income earners in developing countries access safe water. Sister Mary has published a paper on "Application of An Organic Plant-Derived Binder in the Fabrication of Diatomaceous Earth Waste-Based Membranes for Water Purification Systems" in the journal Materials Research Society Advances, and this work is still in progress. In her earlier works, Sister Mary worked on "Application of Raman Spectroscopy in the Detection of Aflatoxin B1 in Maize Kernels and flour." She has done fellowships at BITRI, the Botswana Institute for Technology Research and Innovation, and the University of York.

During this COVID-19 lock down, Sister Mary has been carrying out experiments on water purification using magnetic fields. She has also been working on her Ph.D. thesis. She has been able to submit two papers for publication and she is still drafting two more. Apart from research, Sister Mary has been actively involved in humanitarian acts of feeding the poor during this pandemic.

Focus on the International Training and Research Programme (INTR) at ICTP, Trieste

Petra Rudolf

Young researchers from developing countries who got their PhD in Europe, the USA or Canada are often faced with a dilemma: stay away from their home country because fewer research facilities are available. Therefore, it is challenging to produce scientific output on an internationally competitive level, or go back to build up research facilities in their home country and accept reduced productivity during that startup phase.

Dr. Jorge Mario Salazar Rios (see picture) from Colombia is the first grant awardee of the new International Training and Research (INTR) Programme, set up at the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste in collaboration with the European Physical Society, which targets exactly that dilemma. In fact, the aim of the programme is to award these young researchers grants allowing them to go back for 1-2 months/year to the lab where they did their PhD project, so that they will be able to stay scientifically productive while in the startup phase in their home country.

The INTR Programme is currently supported by donations from the EPS, the Optical Society (OSA) and SPIE, the International Society for Optics and Photonics, the latter two organizations providing dedicated funding for fellowships in the area of optics and photonics. The hope is that other learned societies like the APS, as well as foundations, will decide to support the INTR Programme. The EPS has solicited its member societies to convince the governments of their countries to contribute.

Dr. Jorge Mario Salazar Rios

While the INTR programme is currently focused on organizing short research internships by former PhD students of European institutions, it can be extended both geographically and also to provide longer training research internships for researchers from developing countries who have not done a PhD in Europe, if the corresponding funding can be recruited.

Born in Germany, with a Master's from the University La Sapienza in Rome, a PhD from the University of Namur in 1995, Petra Rudolf is the President of the European Physical Society. She has occupied the chair of Experimental Solid State Physics at the University of Groningen since 2003. Her principal research interests lie in the areas of 2D solids, molecular motors, organic thin films and inorganic-organic hybrids. Rudolf was elected member of the German Academy of Science and Engineering, honorary member of the Italian and the Dutch Physical Societies, Fellow of the Institute of Physics, and Fellow of the American Physical Society. For her work on molecular motors she received the 2007 Descartes Prize of the European Commission. In 2013 she was appointed officer of the Order of Orange Nassau by H.M. Queen Beatrix of the Netherlands.

The Voice of Physical Societies on Horizon Europe (2021-2027)

Angela Bracco, President of the Italian Physical Society

January 1st 2021 will be the day of the launching of Horizon Europe, the program of the European commission running from 2021 to 2027, which has the general objective to deliver scientific, technological, economic and societal impact from the Union's investments in Research and Innovation. Horizon Europe is the 9th framework program and since its starting, in the 1980s, this program has progressively increased its role as a financial and strategic tool to support and implement EU research and innovation policies. In the last two years, the activity for the preparation of Horizon Europe was very intense and resulted in a proposal which is well structured and incardinated on a budget of €100 billion over seven years.

Horizon Europe has three pillars. The Excellent Science pillar supports frontier research projects designed and driven by researchers through the European Research Council (ERC). It also funds fellowships and mobility of researchers through Marie Skłodowska-Curie Actions and invests in world-class research infrastructures. The other two pillars, "Global Challenges and European Industrial Competitiveness" and " Innovative Europe," support research into societal challenges (health, climate change, clean energy, mobility, security, digital, materials, etc.), reinforce technological and industrial capacities and aim to make Europe a frontrunner in creating innovation (for more details see https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme_en). I like to mention that, among others, there is a very large size project presently ongoing with great impact for research and also for education, which fits very well into this strategy, the European Open Science Cloud (EOSC). This project is devoted to realizing the internet for the scientific data, which will provide EU researchers an environment with free, open services for data storage, management, analysis and re-use across disciplines (see e.g. https://www.primapagina.sif.it/article/1175/european-open-science-cloud-e-il-suo-ruolo-in-horizon-europe#.X4hCkS8QP4M).

After several constructive discussions focusing on building the programs in different research areas and on the possible implementations in specific calls, the EU Council's decision to downsize the Horizon Europe budget for 2021-2027 to only €75.9 Bn was announced. It is clear that this decision will put at serious risk the plan to maintain the current position of European R&I in the world, considering that the EU invests only 2.06% of its GDP against 2.13% of China, 2.78% of the United States and 3.2% of Japan.

As a consequence, the European Physical Society (EPS), together with several associated learned societies in Europe, decided to let their voice known on this matter. Letters were sent by the various presidents of the physical societies to the members of the European Parliament dealing with these decisions. The letters were meant to express perplexity and concern towards the decision of the EU Council to reduce the Horizon Europe budget for 2021-2027 and asked to "correct errors" made by EU leaders, emphasizing that "we cannot cut budget resources from Research and Erasmus".

The Italian Physical Society (SIF), after writing such letters, has received up to now rather encouraging answers and in particular, Patrizia Toia, the vice president of the Committee on Industry, Research and Energy, is communicating with us on the actions taking place these days. She also wrote an article on the Italian newspaper "Sole 24 ore" in which she stresses the importance of aligning the national resources (in this case, the Italian ones) to the European research objectives. In this connection in Italy, we have a petition for increasing funds for research within the Recovery Plan, based on a proposal of Ugo Amaldi. A group of scientists led by Luciano Maiani and Massimo Iguscio, and including the present and past presidents of SIF, has written a letter to the Prime Minister, which was published in the newspaper "Corriere della Sera". With its appeal, this letter was so far quoted by our Prime Minister in several of his public speeches.

We now have to wait and be very alert and ready to express our voice if needed when the next decisions are taken. Our community really deserves to be supported being very committed in research which, including that curiosity driven, drives the progress and is vital to overcome these difficult times.

Angela Bracco is Professor of Experimental Physics at the Università degli Studi di Milano and associated to INFN.

Her research activity is in the field of nuclear structure. She collaborates in international experiments focusing on gamma spectroscopy. She is in several international committees for scientific advice and evaluation. She is member of the Accademia Europae and also corresponding member of the Lombard Institute (Academy).

APS International Engagement Around the World

Alex Adams, APS Office of International Affairs

The American Physical Society (APS) aims to serve the global physics community. Readers of the FIP Newsletter may be aware of some of the ways the Society engages the international physics community, but some may be surprised to learn just how far that engagement extends. Approximately 23% of APS members live outside of the United States in over 100 countries. Thousands of physicists from around the world attend and present at APS meetings each year. In 2019, 30% of attendees at the annual March Meeting came from outside of the United States. The 2020 APS Virtual April Meeting drew its largest international audience in history, with over 1800 international attendees representing more than 25% of the total attendance. Physicists living in countries other than the U.S. have authored approximately 70% of the articles published in APS journals. APS members, regardless of nationality, have stated they value "being part of a larger physics community" as a primary reason for joining the Society. APS welcomes the opportunity to serve as a "global hub" where the world's physics community can convene and advance its shared interests.

To assess the interests of APS stakeholders and identify pragmatic goals, the Society launched the Task Force on Expanding International Engagement, which resulted in a report, recommendations, and implementation plan. Many APS members outside of the U.S. have indicated a desire to be proactively included in all APS activities, from programs, Unit activities, advisory committees, and other aspects of the Society's leadership. The Task Force's report acknowledged that while APS has been building new programs for physicists worldwide, adding and expanding international elements to existing APS programs would greatly benefit the broader, global physics community.

In addition to continuing its work to expand the international scope of current activities and programs, APS must also communicate the breadth of opportunities and services currently available to physicists outside the United States. To achieve this, the Society created the APS International Engagement Around the World (IEAW) to highlight, by country or region, APS engagement. The tool outlines the various programs, opportunities, and other resources offered by APS, conveniently tailored to a given region. Any physicist--anywhere in the world--asking "What does APS do for physicists in my country?" can look to the IEAW to see how they can participate in the Society and how APS engages with their community.

At the heart of the IEAW tool is the chance for all physicists to understand the scope of and opportunity for APS involvement in their region, across all areas of the Society. The IEAW highlights relevant APS News articles and publication statistics from Physical Review Journals. Each page displays the current APS International Councilors, who serve on the APS Council of Representatives to provide the perspective of members outside of the United States, highlighting the inclusion of international voices in APS Leadership. Every page also highlights meetings from the APS Meeting Calendar that are of particular interest to the region in question. This includes in person meetings occurring in that region (not just APS meetings) as well as virtual meetings that are accessible to physicists in that region. A quick link to the APS Meeting Archives provides access to presentations and abstracts from previous APS meetings.

Through IEAW regional pages, *any* physicist in any country can see how they can participate in APS and how the Society engages with their community. Browsing the Africa & APS page, physicists in Africa can learn more about APS efforts to enable connectivity and information sharing across the continent through the African Physics Newsletter, written by and for African physicists and published by APS. Scientists from the Middle East viewing the West and Central Asia & APS page could learn more about APS support of training opportunities through the SESAME Travel Award Program. On the China & APS page, physicists in China looking for information on publishing in APS journals or general article writing tips can access recordings (in English or Mandarin) from an instructional webinar organized by APS Editorial Staff and the Chinese Physical Society. Each page is tailored to highlight APS content that is of greatest interest to physicists living and working in that region. Displaying programs in a space designed for a specific regional audience has amplified their visibility to the scientists that stand to benefit the most.

As APS expands its offerings and creates new opportunities, the Society hopes to grow this tool as a valuable way to connect with and serve physicists worldwide. With that goal in mind, APS welcomes feedback from you regarding what programs, resources, and activities would be most useful to physicists in your region. Please contact the APS Office of International Affairs at international@aps.org to give your input on how APS can better serve your region and what you would like to see from our new tool, APS International Engagement Around the World. As APS values the input of the global physics community, we invite you to share this article with your colleagues, including those who may not be APS members.

Alex Adams is the International Programs Administrator in the APS Office of International Affairs, where he enjoys working closely with colleagues and members around the world. Prior to joining the Office of International Affairs, he served as a Membership Specialist in the APS Membership Department and Education Programs Coordinator in APS Programs.

APS Statements

APS Statements are public policy statements that undergo a meticulous process of draft and review, including receiving comments from APS members, before being voted on by APS Council at one of its semiannual meetings. Board Statements expedite the APS Statement draft and review process in cases where more rapid action is necessary.

89.2 The International Nature of Physics and International Cooperation

In consideration of the international dimensions of science and the need of scientists of all nations to maintain professional contact with colleagues at home and abroad, the American Physical Society has adopted the following statement on The International Nature of Physics and International Physics Cooperation:

Science belongs to all humanity and transcends natural boundaries. As in the past, science can serve as a bridge for mutual understanding across political and ideological divisions and as a vehicle for the enhancement of peace. In particular, APS believes that it is important at this time to strive for more open dialogue among scientists to enhance international cooperation.

To achieve its full potential and to benefit all mankind, science requires that governments respect basic human rights, allow open communication, and avoid interference with the rights of scientists as they carry out their professional work.

The APS expects that any action by any government restricting the freedom of inquiry by physicists or the normal performance of their scholarly work be the result of accepted judicial procedures in which the rights of individuals to defend themselves against accusations are not curtailed.

Consequently:

1. The APS deplores actions of any government that deprive physicists of their rights as individuals, their rights as professionals, or their opportunities to meet openly with colleagues at home or abroad

2. The APS deplores the arbitrary closure of universities, research laboratories or conference centers as well as the unjustified physical exclusion of physicists from their place of work.

3. The APS deplores the politically based restrictions on the travel of physicists. In particular, the APS urges all governments to furnish exit visas in a timely fashion to physicists of their countries that have been invited to international scientific conferences or other international scientific activities. It similarly urges that host governments provide entrance visas in a timely fashion to foreign physicists who have been invited to participate in scientific conferences and other scientific enterprises.

4. The APS objects strongly to the substitution of uninvited participants for invited participants at international physics conferences without explicit approval of conference organizers.

5. The APS notes that actions by governments that are inconsistent with the principles stated above erode seriously the willingness of many US physicists to participate in conferences and other cooperative scientific endeavors that involve the offending country.

The APS will continue to take action in support of the human and professional rights of physicists in all countries. It continues to encourage individual physicists and groups of physicists to take conscientious and responsible action to protect those rights and to further international scientific cooperation.

Board Statement on Racism in Physics

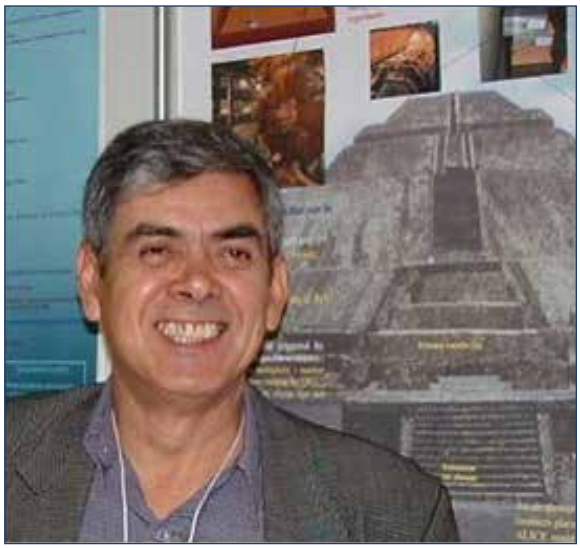
July 24, 2020; Amended September 21, 2020

The current outrage over the killing of George Floyd, Breonna Taylor and others has awakened the conviction that without sustained effective action, systemic racism in America will continue to impede full participation of Black people in many walks of American life, including the field of physics.

Racism has no place in physics. The APS condemns racism in all its forms. But stating this is not sufficient. The percentage of physics bachelor's degrees earned by Black Americans has, if anything, decreased from around 5% in the late 1990's to under 4% now. Only about 1-2% of APS members identify as members of the African diaspora. These appalling statistics cannot be attributed solely to the pipeline and inequities in K-12 education. We ask everyone in the physics community to join us in reflecting on the words of writer and Holocaust survivor Elie Wiesel: "The opposite of love is not hate, it's indifference." We have not done enough to fix a culture in physics that has created and perpetuated practices that fail to support Black participants sufficiently. This failure is longstanding: the first PhD degree conferred in any field to a Black American was in physics, to Edward Bouchet in 1876, yet he was subsequently denied a university position due to his race. We can change the culture and do better.

The APS is committed to transforming the culture and practices of our field to welcome and support the participation of Black people. Our insistence on intellectual rigor, innovative thinking, and excellence demands this transformation. We are working to revise practices with physicists at all levels, ranging from undergraduates to teachers and researchers, who study or work in environments ranging from academic departments and large collaborations to research and industrial laboratories. The reason why this work is critical is simple: Equal opportunity regardless of race is a basic human right.

In Memoriam: Arnulfo Zepeda Domínguez (1943-2020)



Last November 30, 2020 Arnulfo Zepeda Domínguez passed away. It is a tremendous loss for Latin American physics and science in general.

He was one of the key persons of his generation, continuing the work of the historical group of Giambiagi, Leite Lopes, Moshinsky and Tiomno for the development of physics in the subcontinent.

His first interest was in high energy physics, an area in which he collaborated with scientists like William Ponce in Colombia, and Carlos García Canal in Argentina and with whom he shared his vision of a continent active in advanced research.

More recently, he joined the movement for astrophysics research in Latin America that is acquiring great momentum, thanks to the many projects that can benefit from the special geographical conditions of Latin America, among which the Pierre Auger Observatory is prominent.

Arnulfo had been an observer and an actor of the waxing and waning experience of the Latin American Congress of Physics and was a leader in its realization two years ago, corresponding to its 50th anniversary. Until his last days, he was one of the more dedicated people wishing to make this experience happen more regularly.

One of Arnulfo's main contributions to regional development has been his role in setting up the Mesoamerican Center for Theoretical Physics (MCTP) in Chiapas State, Mexico, of which he has been interim director during the first years of its existence. The evolution of MCTP to a Category 2 UNESCO Center owed a lot to his work over the years and was realized shortly before his death. Under his guidance, MCTP has been instrumental in the promotion of a Regional Program of Doctorates in Physics. His legacy to Mexican and Latin American Science will be remembered by these initiatives.

Galileo (Leo) Violini,
Centro Internacional de Física, Bogotá

and

Luis Felipe Rodriguez,
Mesoamerican Center for Theoretical Physics

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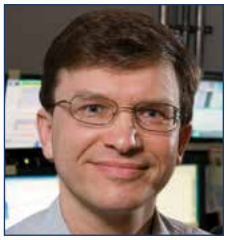

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