

*Happy New Year from the IOP
HEPP committee!*



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IOP Institute of Physics

Joint APP and HEPP Annual Conference

8–10 April 2019, Imperial College London, London, UK



**The annual joint meeting of the IOP
Astroparticle Physics and
High Energy Particle Physics groups**

**Imperial College London
8 - 10 April 2019**

<http://appandhepp2019.iopconfs.org>

Abstract submission deadline

1 February 2019

Early registration deadline

25 February 2019

Registration deadline

29 March 2019

Report from our chairman

Prof. Franz Muheim, University of Edinburgh

A very warm welcome to this year's newsletter. 2018 has been an eventful year for the IOP HEPP group. I would like to start by informing you that at the annual HEPP conference at Bristol I was elected as the new chair the IOP HEPP group committee. Thank you very much for this confidence and I feel honoured. After four years Yoshi Uchida of Imperial College London has stepped down as HEPP group chair. He also retired from the committee after 12 years. Let me use this opportunity to thank Yoshi for his enthusiastic and tireless work for the community over all these years. You will be a hard act to follow. Please note that Yoshi very recently been elected a member of the IOP groups committee which oversees the groups. Many congratulations to Yoshi on his election. I am looking forward to work with him again. It is also my pleasure to thank and say farewell to Helen Heath of the University of Bristol who left the committee after many years. Best wishes to the next endeavors of both Yoshi and Helen.



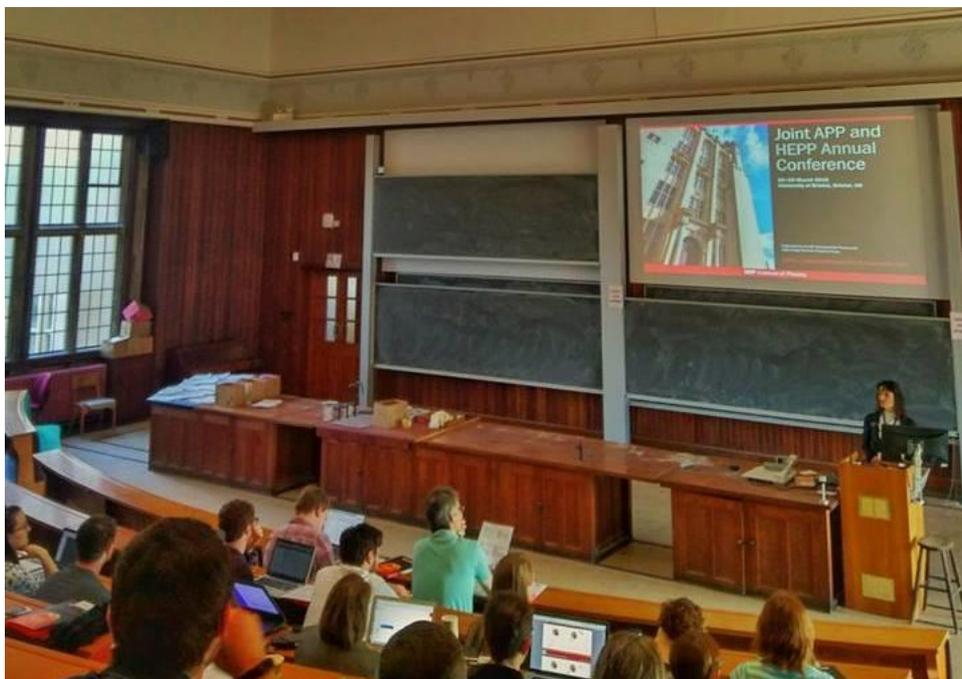
The IOP HEPP Committee on 18 July 2018.

Let me give a very warm welcome to the newly elected IOP HEPP committee members: Andy Buckley and Christoph Englert of the University of Glasgow and Teppei Katori of Queen Mary, University of London together with Baptiste Ravina of the University of Sheffield have joined the committee during 2018 and they have already started contributing. Teppei is also a member of the IOP Astroparticle Physics (APP) group, thus he will ensure that our good relations with APP continue. Baptiste is a new representative for PhD students. Melissa Uchida, of Imperial College London

and now the University of Cambridge, has been elected as Treasurer of the HEPP committee and she is taking over this important role. We have a good mix of committee members from PhD students and early career physicists to junior and senior academics, but it would be useful to add a theory PhD student to the committee. Please contact me if you are interested.

During the last year we have increased our Social media activities. Within the committee Agni Bethani of the University of Manchester has taken over this responsibility. You will find the IOP HEPP group on facebook <https://www.facebook.com/IOPHEPP/>, you can follow us on twitter https://twitter.com/IOP_HEPP, and on Instagram too www.instagram.com/iop_hepp. Chris Parkinson, of the University of Birmingham, and Agni Bethani edited this newsletter and I would like to thank them both for their excellent work. My thanks extend to all members of the committee for all their contributions, including Melissa Uchida for continuing to be very effective in facilitating IOP half-day meetings, and to Trevor Vickey of the University of Sheffield for his work as group secretary. However, to continue to be successful the IOP HEPP group is relying on the support of the community and not only the committee members.

In March 2018 we held a very successful annual IOP HEPP meeting jointly with the APP group at the University of Bristol. The plenary talks were held in the historical Tyndall lecture theatre at the HH Wills Physics Laboratory and we were having a fantastic conference dinner at the Bristol Museum and Art Gallery. We again held the STFC town meeting on the Tuesday afternoon. This seems to work so we plan to continue.



Helen Heath, head of the local organising committee, opening the Joint IOP APP and HEPP conference at the University of Bristol.

I would like to congratulate the prizewinners which were presented at the annual HEPP meeting at Bristol. Asher Kaboth of Royal Holloway, University of London and Rutherford Appleton Laboratory, was awarded the HEPP group prize for his leadership in experimental and analysis methods in neutrino and dark matter physics. Linda Cremonesi of University College London was presented with the HEPP outreach prize

for outstanding contributions to outreach in particle physics. The poster prize was won by Riccardo di Maria of Imperial College London. Next year's annual meeting will be held at Imperial College London from 8 to 10 April. The annual meetings are a long tradition, but it is the enthusiasm of the local organisers which keeps them exciting and useful, and we are looking forward to it. As always, we encourage third year PhD students to submit an abstract for both a talk and a poster.

During 2018 members of the HEPP community have been awarded IOP prizes which were celebrated at a ceremony in London on 20 November. Stefan Söldner-Rembold of the University of Manchester was awarded the James Chadwick Medal and Prize for his contributions to pioneering experimental work in high-energy particle physics and his international leadership in Higgs and neutrino physics. Jennifer Thomas of University College London was awarded the Michael Faraday Medal and Prize for her outstanding investigations into the physics of neutrino oscillations, in particular her leadership of the MINOS/MINOS+ long-baseline neutrino oscillation experiment. I want to add my congratulations to Stefan and Jenny for their well-deserved accolades. Please note also that calls for nominations for next year's prizes are now open and I encourage you to nominate your colleagues.

Looking forward I am very pleased to tell you that the HEPP group has been awarded a significantly larger amount of funds for 2019. Hence, I hope the community will respond by organising many half-day meetings and asking for support. Please contact Melissa in the first instance. In addition, we will continue to support international conferences held in the UK. I would also like to remind students and early-career physicists that the IOP offers funding for travel to international conferences. My impression is that these calls are undersubscribed, thus it is very likely your request will be successful. We also had a recent workshop with the European Physical Society where we agreed to increase our cooperation.

Finally, the Institute of Physics has now moved into the new building to Kings Cross at 37 Caledonian Road London N1 9BU. The building is an innovative design and construction and will be used for talks, debates and performances, physics exhibitions and experiments, conferences, networking events and seminars. If you have an opportunity, please visit.

In memory of

Professor James Stirling CBE FRS (1953 – 2018)

Particle physicists all over the world were shocked to hear the news that Professor James Stirling CBE FRS passed away on 9 November. James was a renowned particle theorist and admired leader of the field of high energy physics. He pioneered significant advances in QCD and phenomenology. Professor James Stirling founded the Institute for Particle Physics Phenomenology (IPPP) at Durham University. He then moved to Cambridge University and to Imperial College London where he became Provost. James served the field on numerous scientific panels on the research councils (STFC and PPARC). He was elected as a Fellow of the Royal Society and was a member of the IOP Awards Panel.

From 2007 to 2012 James was an ordinary member of the IOP HEPP Committee. He left a lasting impression how such a prominent member of the field was dedicated to the activities of the group and he always gave good advice for the younger members of the committee. James was a friendly person, and always had time for people, including students.

We are planning to hold a tribute to Professor James Stirling on behalf of the HEPP community at the next IOP HEPP conference at Imperial College in April 2019.



Prof. James Stirling CBE FRS. Credit: Imperial College London.

IOP prize winners

Prof. Stefan Söldner-Rembold, University of Manchester

For his contributions to pioneering experimental work in high-energy particle physics and his international leadership in Higgs and neutrino physics.

Stefan has been a leading figure in particle physics over the past 20 years. He was physics coordinator of the OPAL experiment at LEP between 2000 and 2001, at a time when the LEP experiments produced the most stringent limit on Higgs boson production that remained valid for more than a decade. Later he contributed to the first Higgs exclusions, around a mass of 160 GeV, at the D0 experiment, where he also developed techniques to identify hadronically decaying tau leptons. Those techniques led to the most stringent limits on supersymmetric Higgs bosons at the time. After two years as D0 physics coordinator, he led the experiment as spokesperson from 2009 to 2011, during which time the collaboration published 68 papers including the first evidence for the Higgs boson decaying to bottom quarks.

Stefan has since become a leading figure in neutrino physics. He was responsible for the construction of the tracking detector for the SuperNEMO experiment and has performed the most sensitive measurement of the double-beta decay of ^{150}Nd . He is currently co-spokesperson of the DUNE collaboration, which has the goal to discover CP violation (matter-anti-matter asymmetry) in neutrino interactions, where he leads more than 1000 collaborators from 32 countries.

Prof. Jennifer Thomas, University College London

For her outstanding investigations into the physics of neutrino oscillations, in particular her leadership of the MINOS/MINOS+ long-baseline neutrino oscillation experiment.

I have been working in the field of neutrino oscillations since the early 90s. The award of the Michael Faraday Medal recognises the contribution to the field of the MINOS and MINOS+ experiments within this field. It was, as many experiments are these days, a very big team effort for which many people should be congratulated. Over the course of a decade, MINOS results were leading the pack in terms of new information on the oscillation parameters until the new generation of experiments took over. MINOS+ provides the best limits on the production of sterile neutrinos in the world from study of the disappearance of muon neutrinos between both short and long baselines.

Presently I am working on the hardest experiment I have ever done: the CHIPS experiment. We are a very small collaboration and our goal is to deploy a 7kton detector in a flooded quarry in the path of the NuMI neutrino beam next summer. We are using inexpensive off-the-shelf components wherever possible along with some electronics innovations using components used in mobile phone technology. The idea is to demonstrate the proof of principle that a very large neutrino detector array can be built for a fraction of the cost of the current generation of neutrino detectors.

-- Jennifer Thomas



Jennifer Thomas and Stefan Söldner-Rembold with their medals, at the IOP Awards ceremony in November 2018.

IOP HEPP group prize winners

Dr. Asher Kaboth (Royal Holloway, University of London, and Rutherford Appleton Laboratory) winner of the HEPP group prize for his leadership in experimental and analysis methods in neutrino and dark matter physics

Asher obtained his PhD from the Massachusetts Institute of Technology in 2012, for his work on the KATRIN and DMTPC experiments. He then moved to Imperial College London, where he worked on the T2K experiment. He became a lecturer at Royal Holloway, University of London, in 2015.

Asher's research is all about detecting extremely rare events. At T2K he studies neutrino oscillation to understand whether matter and antimatter behave differently, which might explain why we see so much more matter than antimatter in the universe. Asher also works on the LZ experiment, which will be the most sensitive liquid Xenon dark matter detector in the world when it begins operation in 2019.



Asher Kaboth.

Dr. Linda Cremonesi (University College London) winner of the HEPP group Science in Society prize for her outstanding contributions to outreach in particle physics

Diverse flavours of neutrino physics

It was an honour to receive the 2018 IOP HEPP Science in Society prize for my passionate promotion of science to diverse audiences across many different media.

I am a neutrino physicist, and love talking about my research to everyone I meet, being that at conferences and seminars, on the radio and podcasts, at public engagement events, or even to random people at the pub or on the tube.

For the most part the general public has never heard of neutrinos, and every time I tell a random person that roughly 1 billion (solar) neutrinos go through their thumb every second, they are usually mind blown! A stream of questions tends to follow, and I love the curiosity that ignites in people's minds when I start talking about my research.



Linda talking about ANITA at the Science Museum Lates.

Since the start of my PhD, I have organised and taken part in a wide variety of public engagement activities. I have co-organised and presented an exhibition of the ANITA experiment at the Science Museum Lates event hosted by the Royal Society in 2017, and at the UCL Kathleen Longsdale building re-opening in April 2018. In both cases I had a mini-model of our experiment in Antarctica (thanks to our UCL engineer Derek Attree), loads of pretty photos of Antarctica, and a cloud chamber. I also got to talk about my experience in Antarctica with one of my personal idols, Sir David Attenborough!

In addition to organising public engagement activities, I am regularly invited to speak about my work at science outreach events all over the UK and world-wide. For example, I have been interviewed at Radio McMurdo in Antarctica, at the Wellcome Collection packed lunch, on the online talkshow The Astroholic, and on the Italian science podcast, Scientificast. I also regularly perform at live events, such as Physics in the Pub and the Cheltenham Science Festival.



Linda talking about neutrino physics at radio McMurdo in Antarctica.

An important part of my public engagement activities is dedicated to LGBT+ audiences. As a queer woman in Physics I connect to the audience by sharing the story of how 9 years ago I moved to the UK, and ended up deciding to pursue a career in physics because of a role model I met back then. It's a story with a happy ending that many people can relate to. I do a lot of public engagement with the charity Pride in STEM, which raises awareness of the importance of LGBT+ diversity in the science, technology, engineering and maths (STEM) fields. With this group I participated in the Pride in London 2018 media campaign and performed science busking during the London Pride Parade (and it was the first time I ever seen crowds of people chanting "science, science!" with such enthusiasm!).



Linda doing stand-up comedy for the Science Showoff LGBT+ event.

Through Pride in STEM I have shared my story and neutrino research at several events as part of the Out Thinkers series. To connect with the LGBT+ audience, I like to explain neutrino oscillations by comparing them to gender fluidity, and the audience loves the parallelism. I was one of the faces of the Royal Society social media campaign during LGBT History Month 2018, and in July 2018 I also was one of the panelists for the Out in STEM event during the Royal Society Summer exhibition. One of my latest challenges was doing a stand-up gig at the Science Showoff LGBT+ special titled "Neutrinos are flavour queer", putting a comedy spin on my work.

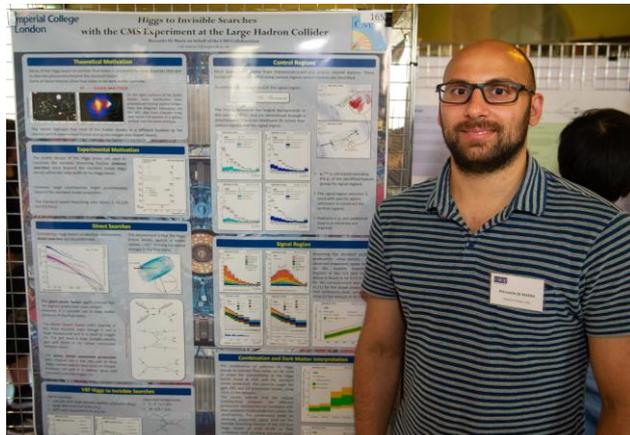
My favourite part of public engagement is connecting to my audience. I often hear people say “I hated science at school, and I’m probably not going to understand your job”. Often those people have the most interesting follow-up questions, and then realise how the tiniest particles can help us unravel the mysteries of the universe.

-- Linda Cremonesi

Riccardo Di Mario, Imperial College London, winner of the HEPP group poster prize

The discovery of the Higgs boson at the Large Hadron Collider (LHC) during Run-1, along with the absence of any significant experimental evidence for physics beyond the standard model (SM), have placed constraints on new physics models. Although the observed 125 GeV boson is compatible with the SM Higgs boson, the existence of non-SM properties is not excluded due to the associated uncertainties. The possibility for further Higgs bosons with exotic decay modes remains, and invisible decay modes could be possible in interactions between the Higgs boson and dark matter, where the former becomes the mediator between SM and dark matter particles.

At the Joint HEPP and APP conference in Bristol this year, I presented searches for invisible decays of the Higgs boson using the CMS 2016 dataset that corresponds to an integrated luminosity of 35.9 fb^{-1} at a centre-of-mass energy $\sqrt{s} = 13 \text{ TeV}$. In order to identify such an event, the Higgs boson must be produced with other particles, and the missing transverse energy (MET) can be exploited to carry out these searches. The vector



Riccardo Di Mario, with his poster.

boson fusion (VBF) channel is the most sensitive due to its characteristic topology and it has high cross-section in comparison with the other production modes. The results are presented in terms of an upper limit set on the branching fraction of the Higgs boson decay to invisible particles, as a function of the VBF production cross-section. The data are in agreement with the contribution of backgrounds from SM processes. An observed (expected) upper limit on the branching fraction $BF(H \rightarrow inv.)$ at 95% confidence level is set at 0.33 (0.25). A combination with other relevant analyses to further improve the sensitivity to $BF(H \rightarrow inv.)$ is also presented using the 2016 dataset. An observed (expected) upper limit on $BF(H \rightarrow inv.)$ at 95% confidence level is set at 0.26 (0.20), assuming SM production rates. The combined expected result represents the most sensitive search for invisible decays of the Higgs boson to date.

I was excited to present this new result at a conference attended by many physicists from all areas of the field. Moreover, it was very stimulating and interesting to be introduced to other similar analyses, and to discuss them with such highly motivated researchers.

-- Riccardo Di Maria

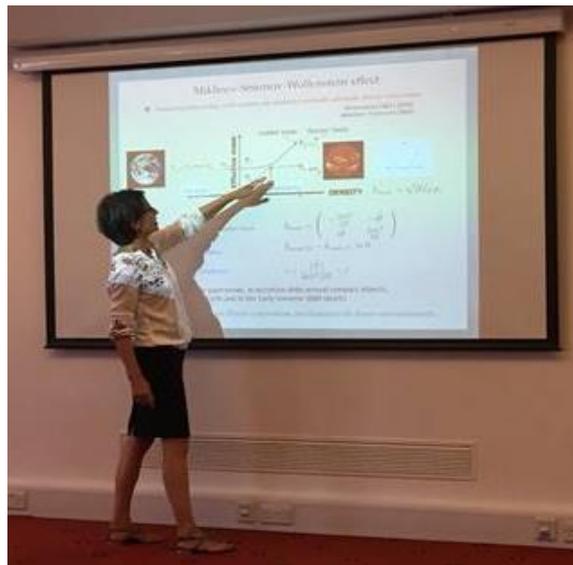
This year's IOP Half-Day Workshops

The IOP HEPP committee has funding available for half-day meetings on any topic of interest to the HEP community in the UK. We have had many interesting and fruitful meetings on topics including Higgs Physics, LHC extensions, Neutrinoless Double Beta Decay: Status and Prospects, The future of Long Baseline Neutrino Oscillation Experiments, Dark Matter, Neutrino Interaction Physics, Gravitational Waves, Exotic hadrons spectroscopy, Exotic phenomena in neutrino physics and many more.

You can apply for up to £500 to fund speakers travel, coffee and lunch if funding allows (attendees travel could also be funded from this but the maximum award is £500 total). To apply simply email the organiser Melissa Uchida at mauchida@hep.phy.cam.ac.uk and write in your email: title, venue, organisers, date (can be tentative) and give a short abstract explaining the topic, remit and benefit of the meeting.

The physics of supernova neutrinos (University of Sussex) Simon Peeters *et al.*

The understanding of Supernova Neutrinos is currently regarded as an extremely important in many sub-fields, including astroparticle physics, nuclear physics, and high energy physics. The neutrino energy spectrum is a key to understand the supernovae explosion mechanisms, as well as the production of heavy elements. Neutrinos can also be used to test fundamental physics, such as the existence of a neutrino magnetic-moment. However, galactic type II supernovae are relatively rare events, and their observation is not easy. The community also considers to detect diffused supernova neutrino background (DSNB). Although each community has an interest in this subject, there are not many opportunities to meet and discuss the status of the topic and see updates from members of each community. The purpose of this one-day workshop was to fill this hole and it was kindly sponsored by the High Energy Particle Physics group, the Astroparticle Physics group and the Nuclear Physics group of the Institute of Physics.



Prof. Cristina Volpe giving her keynote presentation.

The workshop was attended by a healthy number of people (26) from all over the UK. It was opened by Prof. Cristina Volpe (APC, Paris), who gave an excellent overview. Her talk was followed by several more specialist talks by experts in the different subfields. The workshop also gave the opportunity to a few PhD students to present their work. This programme provided the basis of a lively set of discussions throughout the day. We are glad to report that several of those discussions have

continued after the workshop day and new ideas are being pursued by the contacts made that day.

The presentations are available at the web page for the meeting:

<https://sites.google.com/view/snnuworkshop/home>

New physics in kaon and beam-dump experiments (University of Birmingham)

Chris Parkinson *et al.*

The aim of this workshop was to bring together experimentalists and the theory community together, to discuss recent results, forge new collaborations, and to direct future research effort. The workshop covered two main themes: kaon physics and searches for hidden sector particles. These two themes are connected by their ability to probe for new physics in regions that collider experiments cannot.

The workshop was attended by about 25 people, ranging from a small handful of Master's students up to several experiment spokespersons and at least two Fellows of the Royal Society. The workshop opened with recent results in kaon physics, my personal highlight being NA62's first experimental measurement of the $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ branching fraction. Recent progress in the kaon physics theory community, both in perturbation theory and on the lattice, was presented – and generated plenty of discussion.

The meeting then transitioned away from Kaon physics and towards the hidden sector, with both theory and experimental communities being represented. A personal highlight was the talk of Prof. Matthew Wing (University College London) who presented beautiful results from the AWAKE experiment, and discussed prospects for using their high-energy electron beams for beam-dump experiments in the future.

The presentations are available at the web page for the meeting:

<https://www.iopconferences.org/iop/1315/home>



Rado Marchevski (CERN) presents the first results of NA62.

Research student conference fund

The Institute of Physics provides financial support to research students to attend international meetings and major national meetings.

Eligibility: Research Student Conference Fund (RSCF) bursaries are available to PhD students who are a member of the Institute and of an appropriate Institute group. For example, if an applicant is a member of the Women in Physics Group only then they could only seek support to attend a conference related to women in physics and not to low temperature physics. To be eligible for that meeting, the applicant would also need to be a member of the Low Temperature Group.

More details can be found at:

http://www.iop.org/about/grants/research_student/page_38808.html

Early-career researchers fund for HEPP group members

The Institute of Physics provides financial support to early career researchers to attend international meetings and visit international facilities.

Eligibility: For the purpose of this fund, an early career researcher is defined as an individual within three years of beginning their first paid contract of employment in industry or academia, either full-time or part-time, where research and/or the application of physics is the primary function of their role. This excludes any career breaks.

Early career researchers may apply for up to £300.

More details can be found at:

http://www.iop.org/about/grants/early-career/page_67022.html

Messages from the new members of the HEPP committee

This year the HEPP group committee has welcomed a new experimental student representative, Baptiste Ravina, plus three new ordinary members: Andy Buckley, Teppei Katori, and Christoph Englert.

Baptiste Ravina (new experimental student representative)

As a former theory student turned experimentalist (now finishing a PhD at the University of Sheffield), my interests in high energy physics are broad and varied; this is why I am delighted to have been given an opportunity to contribute effectively to the community by joining the IOP HEPP committee!

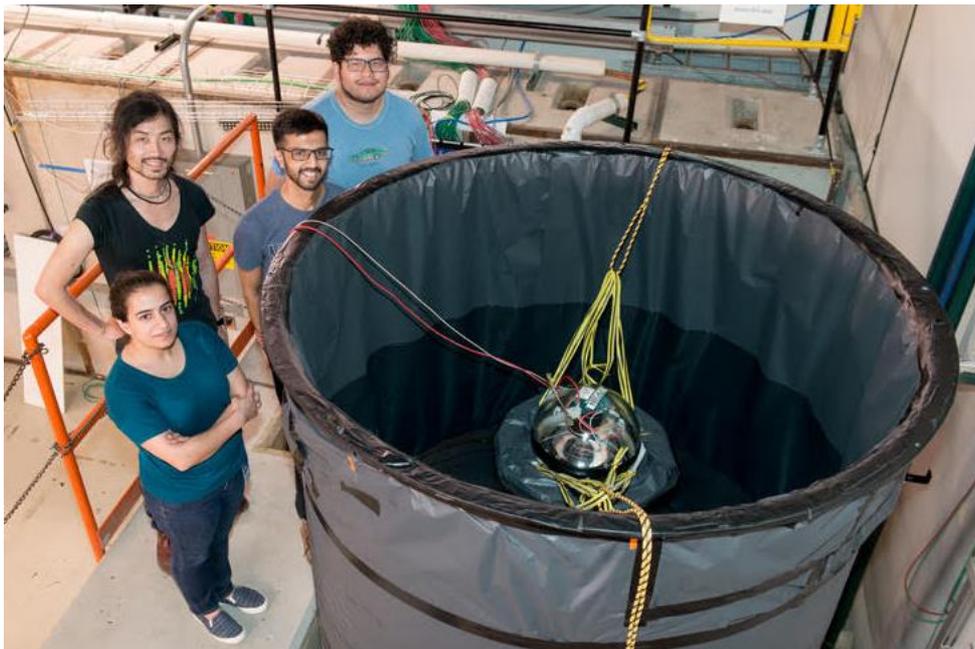
There is of course a lot for me to learn, from organising meetings and workshops (I'll see you at Imperial next year for the annual APP/HEPP conference!), collaborating with colleagues across the many professional fields served by our Group, and helping manage funds to ensure we have a productive and exciting year of physics! As experimental student representative, I do hope I can stimulate further partnership between the IOP and the next generation of physicists in the UK, whether it be by providing them support to attend conferences, realise new outreach ideas or simply by giving them a voice in the future of the field at large. (And if you're a student, why not attend YETI 2019 in Durham, to get a dynamic overview of what we're all about?)

Teppei Katori (new ordinary member)

Hello, my name is Tepei, I am an experimental particle physicist and a senior lecturer at the Queen Mary University of London. I work on a wide range of topics from nuclear physics to particle physics. My main interests include neutrino interaction physics and new physics search using neutrinos.

As a member of the IceCube and Hyper-Kamiokande experiments, I am interested in an interplay of particle physics and astroparticle physics. There are many common interests to work together, and these 2 groups can stimulate each other in many ways. I am serving to be a committee member of both HEPP and astroparticle physics group (APP) to accelerate communications between them and promote joint efforts. These efforts include organizing joint workshops (a recent one is the Sussex supernova neutrino workshop, see page 12). Such workshop has a huge benefit not only for the group members of HEPP and APP, but also for theorists who do not fit in either group. I am interested in to integrate the community to maximize the impact, beyond particle, nuclear, and astroparticle physics, theory and experiment.

Finally, I am running an unofficial IOP APP Facebook page. Please "like" it! (<https://www.facebook.com/IOPAPP/>)



*IceCube PMT test at the Fermilab test beam facility:
astroparticle physics meets high-energy particle physics!*

Andy Buckley (new ordinary member)

I am a senior lecturer at the University of Glasgow, with current research on a mixture of ATLAS experiment analysis, collider event MC simulation & interpretation, and setting limits on new physics by "recasting" broad surveys of published data. I came to this via a PhD in b-physics, and first postdocs as an experimentalist-in-disguise at the Durham IPPP phenomenology institute and am more a jack of all (HEP) trades than a master at any!

We are in an era where researchers are increasingly aware, and critical, of the demands and constraints that academia imposes on our lives... in addition to all the good things. I spent a long (and enjoyable!) time as a postdoc, but as my own personal life became more complicated -- from the classic two-body problem to a three- and then four-body one -- I am increasingly sensitised to the ways that the turbocharged, 100%-commitment ethos of HEP experiments can exclude those with other responsibilities in life. So, on the IOP HEPP committee I am hoping to be a voice for those in such circumstances, at all levels of seniority.

Christoph Englert (new ordinary member)

I am currently a senior lecturer at the University of Glasgow's Particle Theory Group. I joined Glasgow after a couple of postdoc stints at the University of Heidelberg and the IPPP Durham. My main research focus is on collider phenomenology; I am particularly interested in beyond the Standard Model aspects of the Higgs and top quark sectors.

I joined the HEPP committee earlier this year as a new ordinary member. Having had the opportunity to study, live and work in different countries in the past, I am delighted to be able to contribute to the diverse high energy physics landscape of the UK in this way. I hope that my experience can support the committee's work, and I am particularly looking forward to getting involved with the IOP's HEPP-related workshop programme. I am always up for a chat and a pint, so please say hello when you bump into me at some point!

Meet your committee



Franz Muheim (Edinburgh):
Chairperson



Trevor Vickey (Sheffield): Honourary
secretary



Sinead Farrington (Edinburgh)



Mrinal Dasgupta (Manchester)



Agni Bethani (Manchester)



Jarek Nowak (Lancaster)



Chris Parkinson (Birmingham)



Andy Buckley (Glasgow)



Melissa Uchida (Cambridge): Treasurer,
Half days & PAB group cross-member



Baptiste Ravina (Sheffield):
experimental student representative



Christoph Englert (Glasgow)



Teppei Katori (QMUL)

We also have ex-officio/cross members to link with other IOP and STFC groups:

Claire Shepherd-Themistocleous (STFC, co-opted as chair of PPAP)

Elizabeth Cunningham (STFC, co-opted as head of particle physics outreach)

Disclaimer: views expressed herein are not necessarily those of the Institute of Physics, nor are they indicative of any current or future policy of the Institute.