IOP | Institute of Physics
High Energy Particle Physics Group

Newsletter – December 2022

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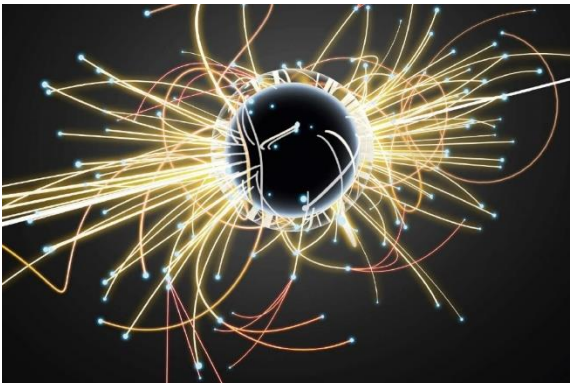
Annual meeting announcement



The 2023 joint meeting of the IOP Astroparticle Physics and High Energy Particle Physics Groups
will be held from 3 to 5 April 2023 at King's College, London WC2R 2LS, UK

See: https://www.iop.org/events/iop-joint-app-and-hepp-annual-conference-3-5-april-2023-kings-college-london-london-uk for details.

STOP PRESS! The 2024 meeting (joint with APP and NP Groups) will be held in April 2024 at the University of Liverpool (exact dates To Be Confirmed.)

Editorial:

This is the first edition of the Newsletter since the pandemic. Although we kept the headline date of December 2022, unfortunately, for reasons outside my control, it did not reach publication until April 2023. I hope to do better next time. For the next edition (Dec 2023), I would like to include more articles from you, the HEPP Group membership. Please send items of interest, with images where possible, for consideration by the Editor: <vincent.smith@physics.org>

Report from the HEPP Group Chair (Melissa Uchida):

It is my great pleasure to write my first report for our Newsletter as Chair of the IOP HEPP group committee. As many of you will know, I have served on the committee for a number of years now and have performed various roles. Over that time I have seen many Chairmen – accurate in this case – fill the position, and all have done so with great care and diligence. I have learnt a lot from each of them, and I hope that I can live up to the high standards which they have set. One thing's for sure, I care deeply about the IOP HEPP Group Committee, the work we do and the community we represent. I hope this passion will serve me, and indeed you, well.

I am often asked about the benefits of joining the IOP HEPP Group – it is not a hard question to answer, there are many reasons. I am particularly proud of our "Half Day Meetings". We understand that the committee cannot represent all of the great work which happens in HEP and so we do not decide the meetings topics ourselves. Rather, these are community led, and required to be of general interest to the community (as opposed to say just one collaboration). They can be a half, full or even two-day meeting and anyone at any career stage can approach us with a great idea which we can then

help you to put on. For the last few years I have acted as Half Day Meetings coordinator and I now pass the reins to Peter Millington who already has his hands full with several upcoming meetings planned for this year already. Take a look at the reports from previous meetings and the advert for future meetings here within.

We also proudly support our early career community through the IOP Research Student Conference Fund and Early Career Researcher Fund. Eligible members can apply for up to £300 during the progress of your PhD or the first three years of paid employment in industry or academia. Applications are considered on a quarterly basis so please check the IOP website and consider applying in advance of your next conference.

The HEPP Annual Conference is considered one of our most exciting events. Held each year around Easter, it brings our community together to share our work and ideas through a varied programme of talks and social events. Last year was our first to be held in person since lockdown, it was a joint event with the APP group, held at the Rutherford Appleton Laboratory in Oxfordshire and featured a spectacular dinner at Williams F1. You can enjoy a full report with pictures in this newsletter. I hope it will bring back some happy memories. This year's conference will be held at Kings College London from 3rd -5th April and is again joint with our APP friends. I hope many of you will enjoy this year's event and indeed the Bubble Chamber Football Tournament which precedes it. Next year's conference will be in Liverpool (dates TBD) and will be joint with our Nuclear as well as our Astroparticle colleagues. I particularly enjoy these larger conferences, especially the parallel sessions where I can learn about the real day to day work which is being done outside of my own field and which I know very little about.

I must now congratulate our HEPP Group Prize Winners. Congratulations to Dr Paula Alvarez Cartelle and Josh McFayden who won our High Energy Particle Physics Group Prize in 2020 and 2021 respectively. This prize is awarded to an early career researcher for outstanding contributions to particle physics research. I would also like to congratulate our Poster Prize Winners in 2022: Zhenxiong Xie, Charlotte Cavanagh, and Sean Hughes; and our 2021 winners: Júlia Silva (ATLAS), Alexandra Moor (DUNE experiment), Soniya Samani (Hyper-K). The 2022 and 2023 HEPP group prizes, 2023 Poster prize(s) and the 2023 Science in Society prize winners will be announced at the annual conference banquet! Details of how to nominate someone for one of our prizes can be found on the IOP HEPP group webpage.

Finally let me welcome, introduce and thank our many new HEPP committee members: Andrew Buckley (treasurer), Jon Butterworth, Herschel Chawdhry, Matthew Malek, Victoria Martin, Peter Millington (Half Day and Conference Coordinator), Konstantinos Nikolopoulos, Cheryl Patrick (APP cross-member) and Vincent Smith. It is unusual to have such a large `changing of the guard' (so to speak), but Tracey Berry, the group secretary, and I couldn't be happier with the wealth of experience, diligence and fresh ideas that they each bring to the committee.

To conclude, I would like to thank Vincent for the care he has taken in putting together this newsletter and also you, the membership for electing me as chair. I hope I will justify your faith in me. See you at the Annual Conference

IOP HEPP Group prize winners:

Recent group prizewinners were:

2020 - Dr Paula Alvarez Cartelle, University of Cambridge. For her contributions to flavour physics.

2021 - Josh McFayden, University of Sussex. For his contributions to electroweak physics at the Large Hadron Collider.

Congratulations to them both!

The poster prize winners at the 2022 Annual Meeting were:

First: Zhenxiong Xie, King's College London

Hyper-Kamiokande sensitivity and systematic uncertainties studies

Runners up:

Charlotte Cavanagh, University of Liverpool

First Results of the 2021 FASER Calorimeter Test Beam

and
Sean Hughes, University of Liverpool

Searching for Axion-Like Particles with The Mu3e Experiment

HEPP Poster prize winner 2021:

Alexandra Moor University of Cambridge

Using Track Direction to Identify Neutrinos in LArTPC Detectors

The 2023 HEPP Group prizewinners will be announced on our website and in next year's Newsletter.

Find out more about the High Energy Particle Physics Group Prize, including past winners.

Find out more about the High Energy Particle Physics Science in Society Prize, including past winners.

Find out more about the High Energy Particle Physics Group Poster Prize, including past winners.

Messages from the committee:

You can catch up with notices of our meetings and other messages at our website:
<High Energy Particle Physics Group | Institute of Physics (iop.org)>

Reports from recent conferences:

IOP HEPP, APP and NPP annual conference 2022

The 2022 IoP Joint APP & HEPP conference was held at RAL from 3-6 April. It was the first in-person conference in the series since 2019, and one of the first large physics meetings held in the UK since the start of the Covid pandemic. Attendance was around 250, with a larger fraction of students than usual — for many of whom this was their first opportunity to attend a conference in person.

The conference "kicked off" with a successful Bubble Chamber Football Tournament, won by the University of Sussex. The physics programme followed the usual format of a variety of plenary and parallel sessions each day, with 4 parallel streams divided into APP and HEPP themes, and a poster session and reception in the evening of the first day. The conference received very positive feedback in general, with a consensus on the excellent quality of the talks and posters and the enjoyment in meeting face-to-face again. The conference excursion and dinner were held at the nearby F1 Williams Experience Centre, with an opportunity for a test-drive of the F1 simulators, and there were also well-attended site tours, public engagement sessions, STFC Town Meeting, and an exhibition.

Jacob Linacre Jacob.linacre@stfc.ac.uk

Young Theorists' Forum 2021

The YTF21 conference took place virtually from 16th - 17th December 2021. YTF is a long running conference organised by a collaboration of PhD researchers from the University's Departments of Physics and Mathematical Sciences. The purpose of the conference is to bring together postgraduate students working in theoretical physics, providing them the opportunity to present their work to a friendly audience.

Given the ongoing COVID-19 situation specifically involving the Omicron variant the YTF committee moved the event to a fully virtual setting. We understand this was not the originally intended format of the conference but we thought it better for the well-being and safety and general enjoyment for the participants and organisers that we make this shift in light of the on-going Omicron variant situation. We hope in following years we may be able to enjoy a physical conference again with all the benefits that will bring.

Regardless of this fact we had 128 registered PhD students that had the opportunity to present in a selection of formats with

opportunities for questions live or offline through our conference Slack. In total we had,

- 7 “gong show” talks (5 minute quick round talks)
- 30 “long talks” (20 + 5 minute talks)
- 7 posters presented via a pre recorded 5 minutes video presentation.

As an additional incentive to engage with all varieties of presentations we provided prizes for the best and runner-up “talk” in each category in the form of £30 and £15 national book vouchers. For the winners in keeping with the lord of the rings theme we also commissioned engraved Lord of the Rings rings “to rule them all” featuring elvish and “YTF21”.

We were very pleased to invite Professor Ruth Gregory of King’s College London to speak with her talk entitled “Return of the String”, in which she told us about much of her previous work and advice for early career progression in PhD and further into academia.

To see the full timetable please refer to our Indico page at https://conference.ippp.dur.ac.uk/event/1065/

Due to the shift to a virtual setting we were unable to make the poster session the relaxed environment for academic and general discussion we had hoped. Each poster was accompanied by a brief summary in lieu of a physical discussion and the participants engaged well with the Slack channel in which they could ask the poster presenters questions at their leisure. Instead we hosted a virtual social on the evening of the 16th December. It was a County Durham themed Escape Room. Players formed small groups on zoom to solve puzzles online, including Google maps and local websites. The fastest team to complete the challenge won a set of prizes: £5 book voucher

per person. (5 people were in the winning team). Players enjoyed learning about various County Durham landmarks.

This year our conference was supported by the Heilbronn Institute for Mathematical Research, London Mathematical Society, IoP Gravitation Group, IoP Mathematical and Theory Group, IoP HEPP Group, IoP Astroparticle Group, IoP Early Carers Members Group, FPUK, UKLFT, Durham University and the Durham University Institute of Particle Physics. We would like to thank all of the sponsors for enabling us to run a fantastic event!

Joseph Walker, Peter Meinzinger and YTF organising committee.
YTF21 committee: Dorian Amaral, Connor Armstrong, Ansh Bhatnagar, Oscar Braun-White, Richie Dadhley, Lois Flower, Hitham Hassan, Edwin Herrera, Stephen Jones, Peter Meinzinger, Dan Milne, Ryan Moodie, Guillaume Rostagni, Jack Shergold, Tommy Smith, Joseph Walker and Mia West.

International Symposium on Multiparticle Dynamics (ISMD)

The 51st meeting of the International Symposium on Multiparticle Dynamics was held in Pitlochry, Scotland from 1-5 August 2022, two years after the meeting was originally meant to be hosted by the Universities of Glasgow and Edinburgh, and a year after the 50th edition was moved to a fully online form for the first (and hopefully only) time.

ISMD is a long-running conference series on all aspects of QCD, cutting across perturbative and non-perturbative regimes, hadron and heavy-ion colliders, nuclear physics, and cosmic rays. This year's meeting, somewhat suppressed by ongoing Covid restrictions and impacts on travel, saw around 85 attendees from the UK and 24 other countries converge on Highland Perthshire. Those who were unable to travel were served by free streaming of the conference sessions on Zoom and posters on gathertown (but not the all-important coffee and mealtime chats), which saw an equal registration to the in-person meeting, particularly assisting engagement from India, China and developing countries. Conference activity was promoted on Twitter via the @ismdconf account and #ISMD2022 hashtag, with positive engagement across the target communities.

The large ballroom of the Atholl Palace Hotel proved an excellent venue, and both the presentations and the environment were greatly enjoyed by all. Highlights were an excellent experimental summary of the contentious CDF mW measurement, complemented by a remote talk on theory inputs and consequences from Peter Athron, and of course the social programme of whisky tasting, excursions to the beauty spots of Queen's View and the Falls or Bruar, and (naturally) a conference banquet with piper, Address to the Haggis, and a following ceilidh. The room allowed participants to sit in a well-spaced manner and we kept fire doors open for ventilation making it as Covid-secure as reasonably possible.

The declared female-to-male ratio was around 1:3, and declared career stages were reasonably well balanced between students, RAs, and academics, in a roughly 4:5:7 proportion that gave the meeting a refreshingly young tone. This was assisted by a set of excellent 5 minute "flash talks" in which mostly early-career poster presenters could promote their work and stimulate discussion in the plenary sessions, and by a substantial programme of travel support from the IoP HEPP, APP and Nuclear Physics groups, STFC, Durham IPPP, and the Royal Society of Edinburgh, SUPA, the Higgs Centre for Theoretical Physics, and the Universities of Glasgow and Edinburgh. The poster prize of £200 was awarded to an outstanding presentation of collinear Z+jet production at ATLAS, by Alexandre Laurent of Carleton University, Canada. On one evening, we arranged for one of our keynote speakers, Alan Watson, to speak at the local Pitlochry Cafe Scientifique. A small panel of other attendees went with him for a Q&A session. This event was very successful with the venue running out of seats!

As a final note, in this era of both Covid and climate crisis, we consider it an imperative to run conferences in an equitable and responsible way. A strong attendance and career balance was achieved in-person via support grants, and careful provision of a remote streaming option enabled those who could not travel to get some benefit -- this was well worth the additional technical complexity of a hybrid meeting. On the second point, we minimised waste by eschewing a traditional conference pack in favour of as-needed stationery, and the estimated carbon footprint of ISMD international travel to Scotland has been offset via tree-planting in Scotland with the Future Forest Co. We hope these initiatives will inspire future meetings to do the same.

Andy Buckley andy.buckley@glasgow.ac.uk

Reports from recent half-day meetings:

King's College London, 25 March 2022 – "UK QFT X"

The UK QFT meetings were established in 2012 by Jean Alexandre at King's College London with the intention of bringing together UK and overseas researchers interested in aspects of quantum field theory. Since then, ten meetings have taken place on roughly an annual basis, hosted by King's College London, the University of Sussex, the University of Southampton, Imperial College London, the University of Nottingham and the University of Manchester. The tenth UK QFT meeting was held on Friday 25 March 2022 at King's College London's Waterloo Campus. Further information about the UK QFT meetings and their history can be found here: https://sites.google.com/view/uk-qft.

This was the first meeting held in person since the start of the COVID-19 pandemic and the first in hybrid format, with 29 in-person and 32 virtual participants. The meeting brought together researchers at all career stages from 29 institutions and 13 countries across Europe, Asia and North America. The talks covered quantum gravity, gravitational decoherence, vacuum instability, finite volume effects in quantum field theory, positivity bounds, the graviton spectral function, entanglement entropy, cosmological particle production, scalar-tensor theories of gravity and driven quantum systems.

A new-found appreciation for face-to-face discussions, combined with the diverse engagement that hybrid formats enable, made for an active and interesting programme. We are grateful to all the participants for making this meeting a success and to the IoP HEPP Group for their generous financial support.

We are looking forward to the next instalment of these productive and enjoyable meetings!

Jean Alexandre, Oliver Gould, Aaron Held and Peter Millington (peter.millington@manchester.ac.uk)

King's College London, 7 April 2022 - Workshop "Supernova Neutrinos in the Multimessenger Era"

The supernova 1987A was the original multimessenger event. 35 years later, this hybrid workshop (taking place at King's College London and online) brought the UK multimessenger community together to prepare for observations of the next galactic supernova, which will be a once-in-a-lifetime event.
Link to Indico page: https://indico.kcl.ac.uk/event/271/timetable/#20220407.detailed

The first session focussed on neutrinos, starting with talks introducing current and upcoming neutrino detectors, including Super- and Hyper-Kamiokande, SNO+ and DUNE. The following talks presented an improved event reconstruction that could improve sensitivity to pre-supernova neutrinos and SN direction reconstruction, work on identifying the supernova explosion mechanism and determining progenitor properties from the detected neutrino signal, and finally future opportunities for neutrino astronomy with direct dark matter detection experiments.
After lunch, the second session focussed on electromagnetic follow-up observations. A first talk introduced the next-generation supernova early warning system (SNEWS 2.0), a network of neutrino detectors designed to alert astronomers when the neutrino burst that predates the visible supernova signal is observed. The following

talks gave an overview over electromagnetic follow-up; discussed specific facilities including GOTO, the Liverpool Telescope and its successor the New Robotic Telescope; and finally introduced CTA's plans to study particle acceleration in supernovae by detecting very-high-energy gamma rays.
The final session of the workshop contained a talk on computer simulations of supernovae and two talks on gravitational wave observations—first on the existing LIGO, VIRGO and KAGRA detectors which could observe GWs from a galactic supernova directly, then on plans for a multi-stage atom interferometry program with AION and AEDGE that could detect the "Gravitational Memory" effect induced by the asymmetry of the supernova.

With over 40 attendees—approximately half in person in London, half online—12 talks and many new connections established in informal conversations during breaks, the workshop was very successful. Many attendees are interested in establishing closer links across the UK multimessenger community and already submitted ideas for future workshops in a similar vein.

Malcolm Fairbairn and
Jost Migenda <jost.migenda@kcl.ac.uk>

Sussex, 15 June 2022 – "One-day IOP workshop on prospects of fiducial cross-section measurements and reinterpretations as a component of searches and measurements at LHC"

The link to the event is here: https://indico.cern.ch/event/1159184/

The workshop started at 10:30 am with a small reception. There were three sessions, with three talks in each session. The talks covered a mixture of theory and experiment topics. The first talk was a

summary and introduction to all differential measurements that have been carried out in the experiments, followed up with two talks dedicated to the reinterpretation packages. Then we heard about how the Standard Model (SM) measurement can be used as a discovery tool and the differential measurement can be reinterpreted in the context of Beyond the Standard Model (BSM) scenarios. A talk was dedicated to possible BSM explanations for the persistent anomalies, e.g, the muon magnetic dipole. In addition to theory talks on Precision Monte Carlo modeling of multi-boson processes and multileption signature, there were two talks on ongoing efforts for differential measurements of Di-boson processes in the ATLAS experiment.

The workshop was in a hybrid format. We had around 25 people joining the workshop in person and between 15-20 people who attended this workshop online. Among nine talks, three were given on zoom. The workshop went very smoothly with plenty of discussions around the presented topics presented. The workshop was an opportunity to learn and share ideas about possible BSM models that would explain the observed anomalies and become familiar with the well-developed reinterpretation software packages that could be used to set a limit on possible BSM scenarios. Many found the topics very interesting and the workshop provided a friendly environment for everyone to contribute to the discussions.

People who helped me with the workshop are : Iacopo Vivarelli, Kate Shaw, Andrea Benfi, Jonas Lindert all from university of Sussex.

I would like to thank you for the support, surely this event couldn’t happen without the funding from IOP HEP group.
Batool Safarzadeh Samani

Oxford, 5 July 2022 – IOP HEPP UK meeting on future e+e- Higgs/EW/top/... factory

The particle physics community agrees that the next major accelerator project should be an electron-positron collider to perform precision studies of the Higgs boson. This goal can be realised either by a linear machine, such as the ILC in Japan or CLIC at CERN, or by a circular collider -- the FCC-ee at CERN. Each of these facilities would also have, to differing degrees, the capabilities of delivering a rich physics programme at lower and higher energies, including electroweak, heavy flavour and top studies, and in direct searches.

A half-day meeting took place in Oxford on the July 5th that gathered together UK electron-positron enthusiasts to discuss these opportunities, with 35 people attending in person, with a similar number connecting over Zoom. Rather than discuss the individual merits of each facility, the meeting focused on the detector challenges that would exist at any electron-positron machine, noting that the requirements are largely common between the projects.

After a set of introductory talks to set the scene, sessions followed on vertexing and tracking, calorimetry, particle identification, trigger and data acquisition, and software and reconstruction. Productive discussion ensued on the mechanisms by which R&D in these areas could be supported, to ensure that the UK would be well positioned to take a leading role on whichever project is approved. It was agreed to schedule follow-up events which would explore how to make UK efforts more coherent in key areas.

Philip Burrows, Christos Leonidopoulos, Aidan Robson and Guy Wilkinson
Guy Wilkinson <Guy.Wilkinson@cern.ch>

Plans for future meetings:

Proposals are welcome for future meetings.

Meetings can be on any area of particle physics but should be of interest to the community at large, bringing together experts and non-experts from different areas of the field. Applicants can request up to £500 for a half-day meeting or £1,000 for a full-day meeting (or £750 and £1,500 respectively for a half- or full-day meeting supported by more than one IOP Group). Please consider carefully whether a full-day meeting is necessary or whether a half-day meeting would improve attendance from the wider UK and Ireland HEPP community.

Additionally, for multi-day conferences, applicants can request up to £1,000 for the first day and £500 for each additional day (or £1,500 for the first day and £750 thereafter for a conference supported by more than one IOP Group).

If you have an idea for a meeting and would like to discuss it further, please contact Peter Millington at peter.millington@manchester.ac.uk with the following details:
Title
Venue
Organisers
Date (This can be tentative.)
Amount requested
Abstract (Please give a short abstract explaining the topic, remit and benefit of the meeting. Please do remember that the meeting needs to be of broad interest to the community, and therefore, while obviously focused, it should not only be of interest to say a single collaboration.)

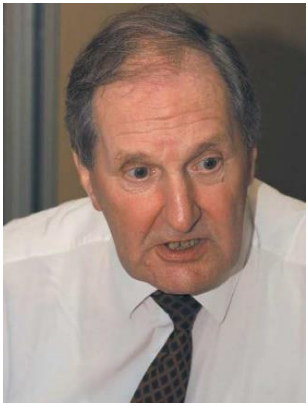
If support is agreed, we would ask that you include the IOP HEPP Group logo on all materials, that the Group's support is verbally mentioned in the welcome, and that you send us the following information after the event:

- Total number of speakers and participants
- Ratio M:F:Other:PreferNotToSay of speakers, organisers and participants
- A summary of the event for inclusion in the newsletter

Donald Perkins Obituary:

Don Perkins , who died in October 2022 at the age of 97, was a towering figure in the study of the particles and forces that govern the evolution of the Universe.

Perkins came close to winning the Nobel Prize on more than one occasion.



Donald H Perkins CBE FRS 1925-2022

One was his publication in 1947 in the journal “Nature” of what, in hindsight, was the first observation of a new particle, the pion. Cecil Powell won the 1950 Nobel Prize for firmly establishing the pion’s existence. The second derived from the incredibly rare collisions between the phantom neutrinos that fill our universe and the atomic nucleus. This led to the observation of a new variety of the force that governs radioactive decay and how the Sun shines.

Donald Hill Perkins was the son of George and Gertrude Perkins. He was born in Hull, where he attended the Malet Lambert High School. He took his undergraduate degree at Imperial College London, followed by a PhD under the supervision of G.P. Thomson, another Nobel Laureate. During his thesis work he convinced Thomson to use his influence from his wartime work to get Perkins on an RAF transport plane. Flying as high as possible to maximise the flux of

cosmic rays from outer space, Perkins exposed his photographic emulsion, a new medium for detecting particles. When developed, the emulsion revealed the tracks and interactions of electrically charged particles. It was this exposure that gave Perkins the material for his “Nature” publication referred to above and for his thesis, which he completed in 1948.

In 1951, Perkins joined Cecil Powell in Bristol and immersed himself in understanding the complex pattern of particles that the emulsion technique was revealing. He worked closely with Peter Fowler, grandson of the great Lord Rutherford. They discovered some of the ways in which the pion decays, exposing their emulsions via expeditions to mountain summits of the Pyrenees, Alps and Andes and unmanned balloon flights to the stratosphere. Both were dangerous; mountains have their obvious perils but the gases used to fill the balloons were explosive. One accident left many physicists with singed hair. Perkins and Fowler were, in 1961, the first to suggest that irradiation with negatively charged pions might form an effective cancer treatment; they also collaborated with Powell to publish the “bible” of the nuclear-emulsion technique in 1959.

By the early 1960s, Perkins realised that the emulsion technique was being superseded by others, notably electronic counters and bubble chambers. In the latter, macroscopic bubbles form along charged-particle trajectories in pressurised liquids. In 1965, Perkins moved to Oxford. Working with Sir Denys Wilkinson, Perkins established a world-leading particle-physics group. Perkins used the Gargamelle bubble chamber at CERN, the particle-physics laboratory in Geneva, where he had his second brush with the Nobel medal; the discovery there in 1973 of “neutral currents” of the weak force by Perkins and collaborators was seminal and many believe Nobel-worthy.

Perkins could be scathing about the wilder speculations of theorists, reminiscent of Lord Rutherford, with whom he shared a booming voice and infectious laugh. However, he was razor-sharp in picking out key theoretical concepts and devising experiments to test them. When results from electron-scattering from protons at Stanford Linear Accelerator Laboratory were published in 1968, Perkins adopted Richard Feynman's explanation invoking point-like partons inside the proton. Perkins realised that neutrino scattering could give complementary information. The combination of electron- and neutrino-scattering data gave clear indications that partons were indeed the fractionally charged quarks, proposed earlier by Gell-Mann and Zweig. Perkins recounted that when he presented the neutrino results at a seminar, Feynman exclaimed "Hot dog!". Subsequently, Perkins was also in the vanguard of experimenters who were convinced by Quantum Chromodynamics, the theory of the strong nuclear force, which explained why quarks were perpetually imprisoned inside the proton.

In the late 1970s, Perkins turned his attention to the possibility of proton decay – coining the phrase "Are diamonds forever?". He was a pioneer of Soudan-II, a 1000-ton block of instrumented iron that sat deep underground in a mine in Minnesota to shield it from the inimical background of those very cosmic rays that had been his first love. Soudan-II began operation in 1988; although it never saw evidence of proton decay, this and similar experiments became unique observatories for neutrino astronomy, in particular neutrinos emanating from supernova explosions.

Neutrinos were never far from Perkins' thoughts. In the early 2000s, with collaborators Harrison and Scott, he devised new methods to describe the quantum-mechanical mixing that occurs between the three distinct types of neutrinos. This "HPS mixing" still gives rise to theoretical papers today.

A distinguished career brought many honours. Among the first was election as Fellow of the Royal Society in 1966, followed by a Royal Medal in 1997. In 1991 he was appointed CBE. Perkins was the recipient of three honorary doctorates and numerous prizes from the learned societies of Europe.

A charismatic teacher, Perkins' undergraduate lectures formed the basis for his world-renowned text, "Introduction to High Energy Physics", first published in 1972 and now in its fourth edition. It educated many of today's leading particle physicists and indeed often attracted them into physics.

Although often impatient with administration, Perkins shouldered his share of such duties, serving periods as head of subdepartment in Oxford. He was Chair of the Nuclear Physics Board of the Science and Engineering Research Council from 1985-89. However, he was always happiest when thinking about physics; it was in prestigious international advisory committees, such as the CERN Scientific Policy Committee, and in international strategy meetings, such as that in 1979 leading to the construction of the HERA electron-proton collider in DESY, Hamburg, where his advice was often heeded. Charismatic, far-sighted and fearless, his voice, often the first to be heard, carried enormous weight. His distinctive northern accent, and even more distinctive laugh, will be greatly missed by his colleagues and many friends.

Donald Perkins married Dorothy Maloney in 1955. She predeceased him in 2021; he is survived by his two daughters, Michele and Venetia.

Reproduced by kind permission of Brian Foster (Oxford).

Meet the committee::

Chair:

Dr Melissa Uchida, MinstP

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University of Birmingham

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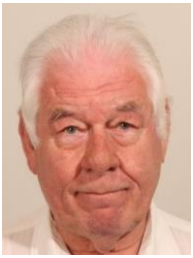
Dr Cheryl Patrick, MInstP

University of Edinburgh



Ordinary Member and Newsletter Editor:

Dr Vincent Smith, MBE FInstP

University of Bristol