Particle Physics Advisory Panel (PPAP)

Annual Theory Meeting 2024, Durham University

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18th Dec 2024

IP3

UKRI Science and Technology Facilities Council

Durham University

- Particle Physics Advisory Panel (PPAP) one of five STFC advisory panels
- Provides link between scientific community & Science Board & present needs of community to STFC

Ruben Saakyan – UCL (Chair)

- Tracey Berry – Royal Holloway
- Andy Buckley – University of Glasgow
- Davide Costanzo – University of Sheffield
- Henning Flaecher– University of Bristol
- Elena Gramellini – University of Manchester
- Helen O'Keeffe – University of Lancaster
- Joe Price - University of Liverpool
- Arttu Rajantie – Imperial College London
- Rebecca Seviour– University of Huddersfield
- Jessica Turner – University of Durham
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Activities

- Engagement with community at IoP & Annual Community Meeting
- Respond to requests for advisory information e.g. UKRI infrastructure call
- Science Board (PPAN) has developed a 10-year prioritised Roadmap guide future STFC investments in the PPAN science areas. PPAP & other panels provide input to this roadmap.
- Input to European Strategy for Particle Physics Update (ESPPU) 2026

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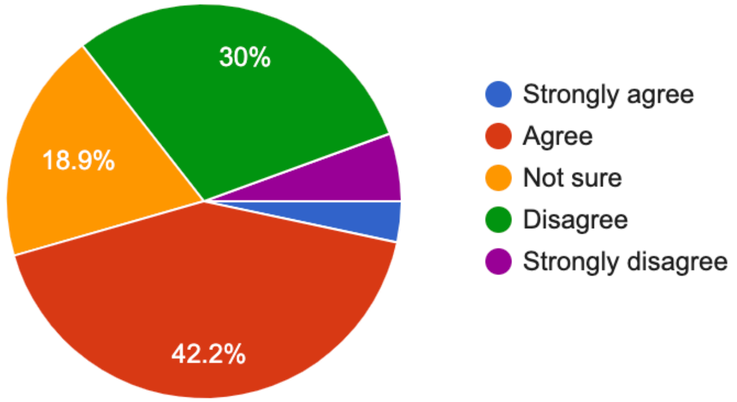
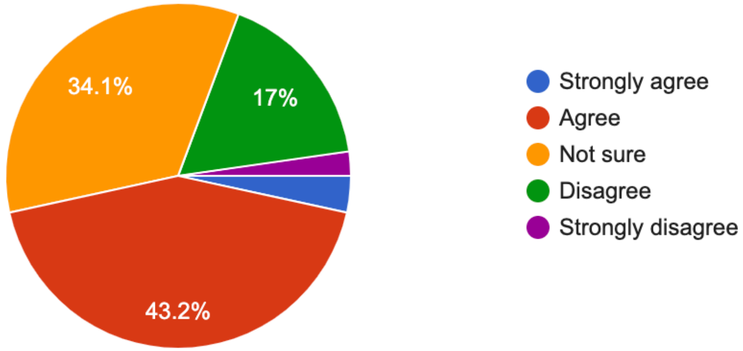
- ~100 respondent, as groups and individuals, ~28% ECRs
- Top scientific challenges: neutrino properties, dark matter, Higgs properties, flavour physics, GWs, precision SM measurements, baryogenesis
- **Is there good balance between science areas (neutrinos, DM, collider, QTFP, accelerators, flavour)?** Even split between yes and no



- **Is theory well placed to guide the experimental programme?**



- Theory is underfunded & needs better connection with experiment. Partly because there are two separate Consolidated Grant panels. There could be funding streams that support joint ventures

- MC strong, need neutrino cross section support & QTFP

- IPPP associateships are good source of theory experimental connection but not well advertised (currently advertised in HiFi & IPPP newsletter)

- Accelerator & Detector R&D underfunded. Lack of funding for blue-skies research

- **What was not captured in the 2021 roadmap?**

- Kaon physics, SHiP (forward physics programme), Boulby Lab to possibly host DM exp, QTFP, EIC, neutrino cross sections

- Scenario planning, sustainability & ability to attract and retain talented ECRs

- **What was important short, medium & long term infrastructure requirements?**

- Boulby Lab, Accelerator & Detector R&D [for future collider], computing

- **Clear excitement from accelerator physicists about a muon test beam.** Disconnect between collider exps & accelerator physicists. The latter is not underfunded or under subscribed

- **Not clear what comes next for collider physics:** e^+e^- Higgs factory (linear or circular), or FCC-hh

- **Clear excitement about Boulby Lab.** Could host XLZD. Tensions between funding such a large experiment and smaller experiments.

- **Clear Experimental Landscape for Neutrinos** (DUNE, HK) with investments in NDBD. UK involved in 5 neutrino observatories with one UK lead (P-ONE).

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- ECFA-UK Meeting Durham - 23-26 September 2024
- ECFA Meeting brought together experimentalists & theorists from all particle physics areas to discuss particle physics goals for European Strategy For Particle Physics Update
- First Drafting Meeting for European Strategy in Daresbury - 4 Nov 2024

3a) What should be CERN's next flagship collider project?
b) What key factors should inform this decision?

- Physics potential
- Long-term perspective
- Resource implications (financial, human, and impact on other projects)
- Timing
- Careers and training
- Sustainability

c) Should CERN/Europe proceed with the preferred option, or consider alternatives in these scenarios:
i) Japan advances the ILC in a timely manner.
ii) China develops the CEPC on schedule.
iii) The US commits to a muon collider.
iv) Major unexpected results arise from HL-LHC or other experiments.

d) Beyond the preferred option, which accelerator R&D topics (e.g., high-field magnets, RF technology, alternative accelerators) **should be prioritised?**

e) What is the prioritised list of alternative options if the preferred project is unfeasible (e.g., due to cost, timing, or international developments)?

f) What are the key considerations for 3e)?

4) The ES update should prioritise non-collider physics areas and experiments both at CERN and other labs. National inputs should explicitly state preferred priorities for non-collider projects.

a) Which other physics areas should be pursued, and how should they be prioritised?

b) What factors should guide this prioritisation? (Refer to considerations in 3b).

c) To what extent should CERN engage in nuclear physics, astroparticle physics, or other sciences, while adhering to the CERN Convention? Use current activity levels as a baseline.

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- Survey conducted around these questions & first draft statement can be found in this google doc
- Additional comments can be found here, provide feedback on slido
- Second hybrid drafting meeting 9th Jan @ UCL. Today is deadline for registration
- We would like further input from theorists, how do we best facilitate this?