UNIVERSITY OF LIVERPOOL

End of year meeting

Particle Physics research group

Joost Vossebeld

UNIVERSITY OF LIVERPOOL

PARTICLE PHYSICS FUNDAMENTAL SCIENCE ENGINEERING IMPACT TECHNOLOGY OUTREACH PARTICLE PHYSICS FUNDAMENTAL SCIENCE

2 A very sad start

The totally unexpected loss of Barry King was a great shock.

Head of Research Cluster

In February Themis Bowcock stepped down from this role as head of the research cluster.

A huge thank you to Themis who leaves the group stronger than it has ever been.

A HEP cluster with around 65 staff and 60 PGR students AND most importantly a very broad and exciting research programme:

It is a great privilege and responsibility to take over the role at this point.

My thanks also to Julie, the management team and others helping me get started in this role.

Other changes to the group

Departures:

Academic: Yanyan Gao,

PDRAs: Adrian Pritchard, Stephen Dennis (Jan.20), Karlis Dreimanis (Jan.20)

New arrivals/appointments:

New academics appointments: Carl Gwilliam & Joe Price

Jon Coleman – Appointment to Reader from RS fellowship

Eva Vilella – UKRI Future Leaders Fellow

New Chairs: Costas Andreopoulos, Neil McCauley, Andrew Mehta, Uta Klein

Other new arrivals:

New PDRAs: Adam Roberts (ARIADNE), Lauren Anthony (T2K), Vinicius Lima (LHCb), Andrew Carroll (Atom Interferometer), Cristiano Sebastiani (ATLAS), Eduardo Rodrigues (LHCb)

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PARTICLE PHYSICS FUNDAMENTAL SCIENCE ENGINEERING IMPACT

5 PhD students

Excellent talks by year 1,2 & 3 students yesterday. Year 4 students present a poster today.

Successfully completed: Talal Albahri, Mohammed Ahmed, Emily Graham, Heather Wark, Adam Roberts, Vinicius Lima, Lauren Anthony, Jonathan Tinsley, Pratiksha Paudyal, Andrew Carroll, Richard Moore







We welcomed nine new students:

James Smith, Sean Hughes, Anthony Hibbert, Abbie Chadwick, Jaiden Parlone, Leonie Hawkins, Jan Hammerich, Gloria de Sa Pereira, Adam Abed Abud.

Congratulations to Francis Bench, winner of the 2019 Rutherglen PhD prize!!!

2019-2022 consolidated grant

- New consolidated grant, £8.9M (previous CG was £8.3M and covered 4 years of salaries for aprt of our staff.)
- In general, existing CG posts continue to be funded.
- Two new PDRA posts awarded.
- Funding for cleanroom/workshop and consumables
- Travel and computing equipment support have been reduced!

Reviewer were impressed by the broad physics programme supported by the Liverpool group and praised our unique facilities.

2019 news

Neutrino highlights

DUNE production grant awarded

WATCHMAN funded

Successful demonstration of performance ARIADNE readout

Most recently HK project approved in Japan

LHC highlights:

- Continuing to produce large numbers of excellent physics results.
- Liverpool module production for ALICE-ITS successfully completed
- LHCb pixel-VELO assembly has started
- ATLAS strip and pixel upgrades are moving through final stages of pre-production
- New R&D on machine learning in online systems (VeLo Tracking) with FBK and Microsoft

And more news

Dark Matter:

- LZ approaching start-up
- Funding for R&D into 3rd generation experiment
- CTA successful results with small camera system (not simulation)

HV-CMOS

- Major boost to HV-CMOS work with Eva's FLF award

Outreach

- Machine Learning for Scientists: training by Kurt Rinnert in Guatemala for ICTP Physics Without Frontiers

Projects in the pipeline

Quantum Sensors for Physics

- MAGIS-100/AION proposal submitted for funding

Dark Matter:

- Proposal to join Darkside-20T Liquid Argon DM (SoI stage)

Neutrinos

- Proposal to join LEGEND-1T $0\nu\beta\beta$ experiment (SoI stage)

LHCb

- Proposal for phase 2 upgrades at SoI stage (VeLo, RICH, Inner Tracker, Computing)

Other projects/ideas are under development, but not yet with concrete plans yet for funding applications (LHEC, FCC, CEPC, pEDM, FASER, ..)

A look ahead at 2020

Feb/Mar recruitement 2020 PhD students

- Fewer GTA awards than in the previous year, but we are still very successful at identifying external matched funding, may soon need to find full funding externally.

Fellowships:

- Increasing number of schemes available in the UK: Royal Society, Rutherford, ERC, UKRI Future Leader Fellowships, UKRI Alan Turing Fellowship.

Consolidated grants process starts again!

- Writing of the 2022-2025 grant will start in October 2020!
- Early 2020: management committee to meet with each PI with to start develop the case for each post.

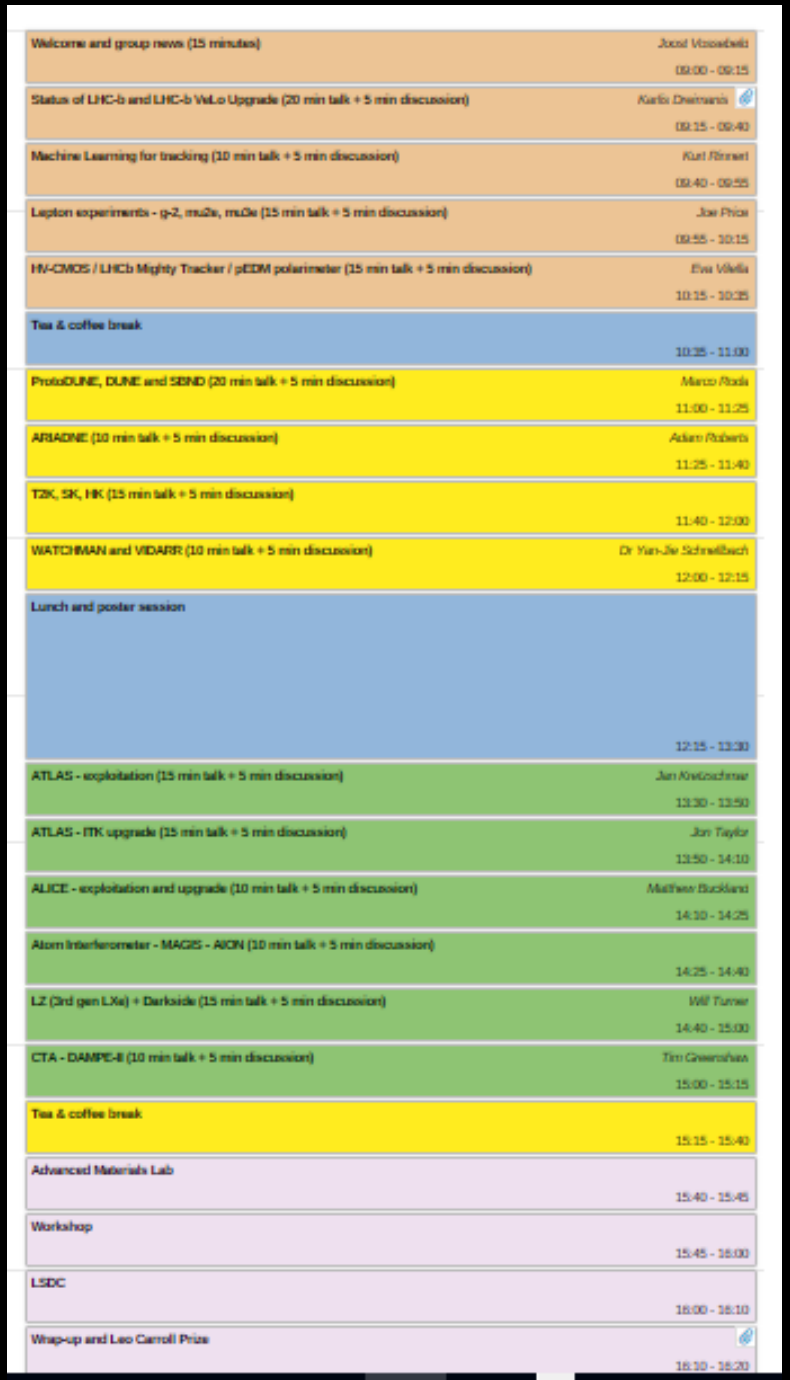
REF'21 submission date: 27 November 2020

Collection of papers, impact cases, ..

The Meeting today

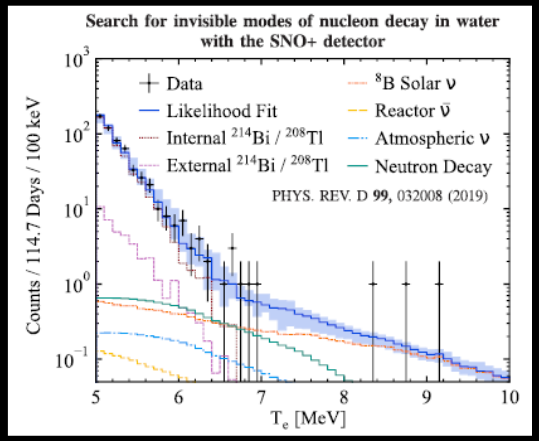
Most experiments, main R&D areas and future projects are covered in talk today.

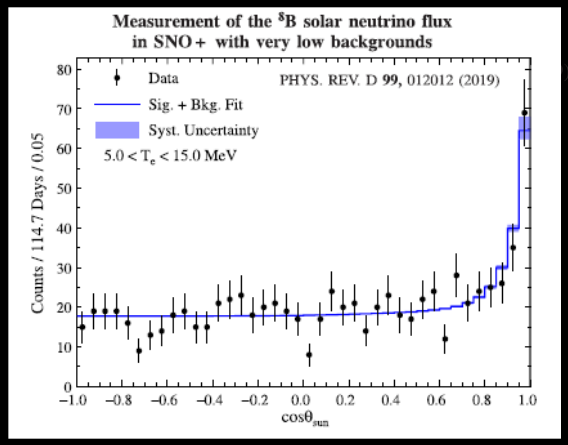
No talk on $0\nu\beta\beta$, so I will show a few slides



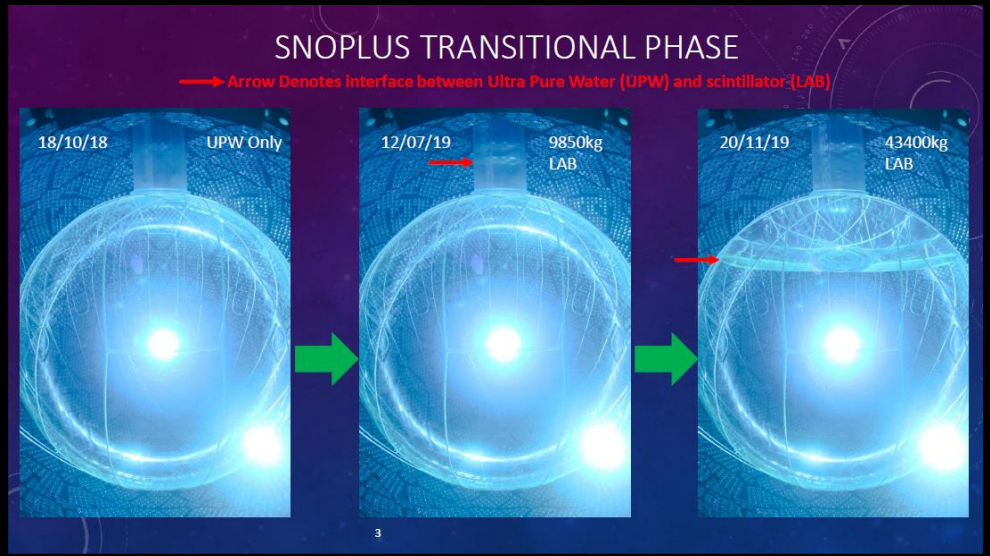
SNO+

From Joachim: First SNO+ water phase results published on nuclear decay modes and Boron solar neutrino flux





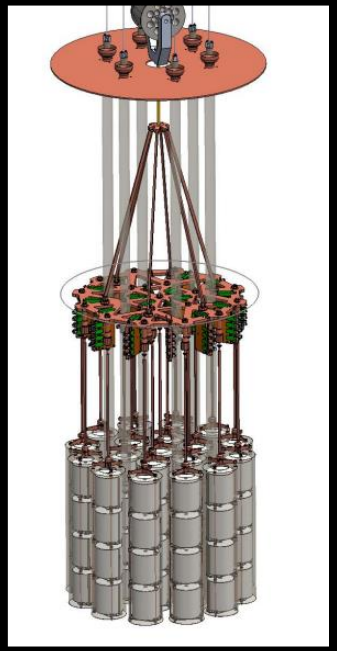
See also presentation Matthew Cox yesterday:
Nice pictures of replacement water with scintillator
Followed by Tellurium loading.



LEGEND - Search for 0νββ in Germanium

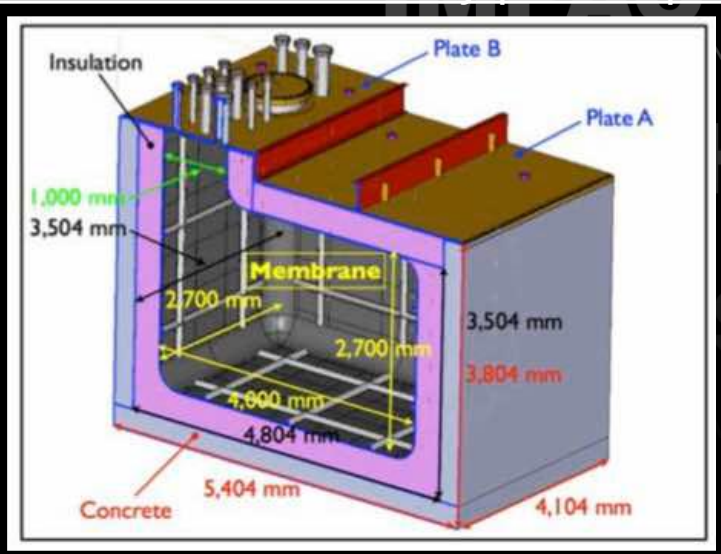
The LEGEND collaboration aims to build a 1-tonne Ge experiment with half-life sensitivity for ^{76}Ge of ~ 10^{28} yr.

Sensitivity to cover all of inverted hierarchy and much of normal hierarchy phase space



LEGEND-200
Re-use GERDA cryostat
At Gran Sasso
Start-up: 2021

LEGEND-1T
Using DUNE like cryostat
At Gran Sasso or SNOlab
Start-up: ~2029



UK groups have submitted an SoI to Science Board
Liverpool, UCL, Lancaster, Manchester, Warwick
WP1: HPGe Detector Development & Characterisation
WP2: Material Screening & Assays.
WP3: Active Veto Technology
WP4: Software & Analysis

LEGEND

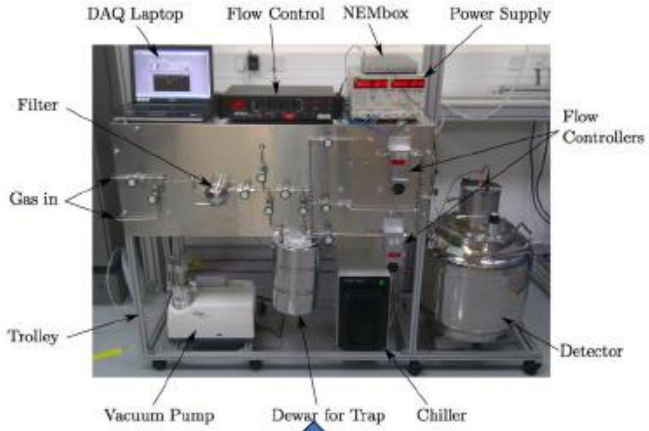
Bid to opportunities call funded by STFC to enable start-up

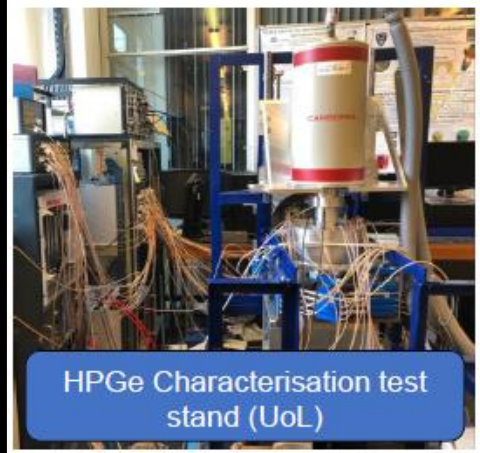
LEGEND Large Enriched Germanium Experiment for Neutrinoless ββ Decay

Neutrinoless Double-Beta Decay and Germanium Detector Technology

University of Liverpool, University College London, Lancaster University, University of Warwick

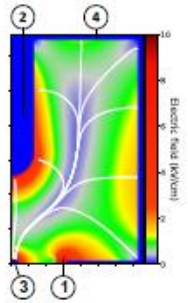
- Opportunities call research Plan:
  - WP1 HPGe Characterisation and Technology Development
  - WP2 Simulation Studies for Tonne-Scale 0νββ Experiments
  - WP3 Radio-purity Assay Campaign for LEGEND
  - WP4 Novel Scintillating Material Development for LEGEND
- LEGEND-design HPGe detectors have a broad range of applications (environmental monitoring, ^{210}Pb dating, nuclear decommissioning) Working in collaboration with Mirion Technologies these applications will be explored.





HPGe Characterisation test stand (UoL)

Proposed new detectors for LEGEND:
P-type Inverted-Coaxial Point Contact
Larger mass : > 2 kg/detector



Radon Concentration Line & ICP-MS facility (UCL)