AIMS OF APPEC COMMUNITY MEETING ON NEUTRINOLESS DOUBLE BETA DECAY

https://www.appec.org

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University of Zurich
London, October 31, 2019

APPEC OBJECTIVES

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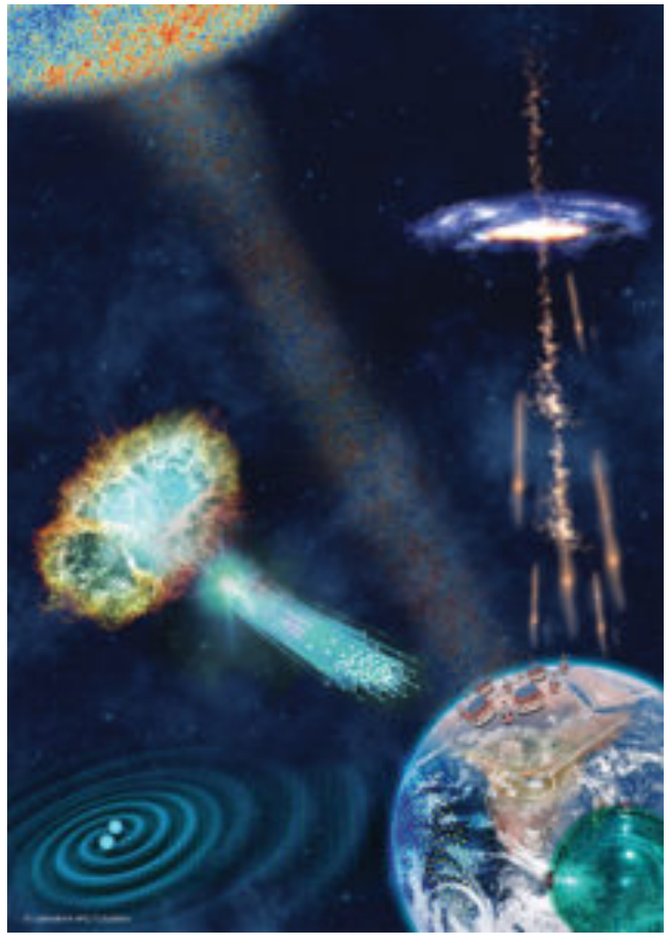
- Provide a discussion forum for the coordination of European Astroparticle Physics and express collective views in international fora
- Develop and update long term strategies - e.g., Roadmap for European Astroparticle physics
- Participate in the European scientific strategy and develop closer relationships with CERN, ESA, ESO
- etc.. (see website)



- Facilitate the implementation of the recommendations of the roadmap: European Astroparticle Physics Strategy 2017-2026

https://www.appec.org/roadmap

THE APPEC CONSORTIUM

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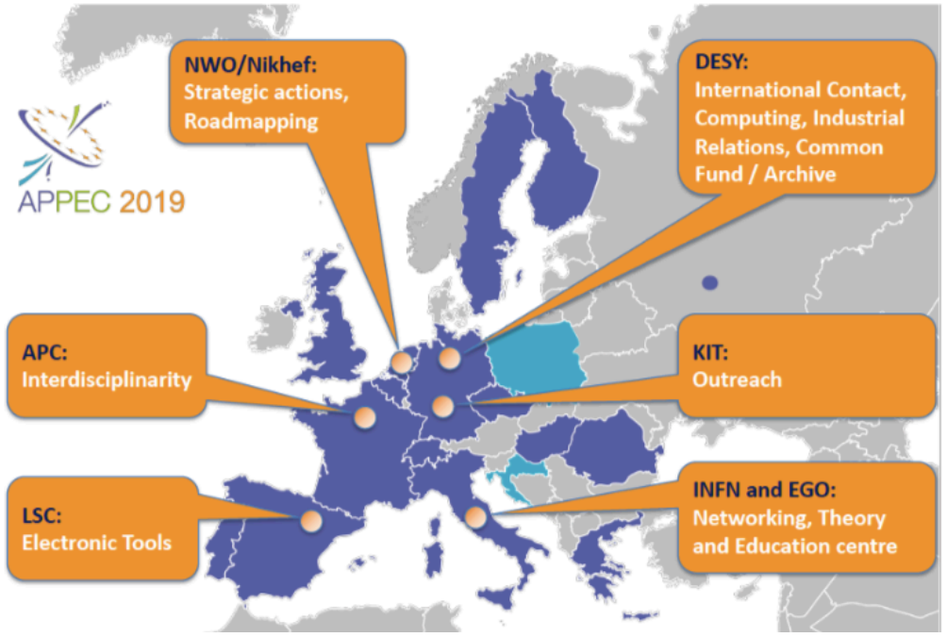
- APPEC MoU approved in 2012
- Organisation:
  - General Assembly: strategic, decision making and supervisory body; chair T. Montaruli; deputy chair C. Stegmann; general secretary: J. de Kleuver
  - Scientific Advisory Committee: advisory body of the GA; chair L. Baudis; vice-chair J. Monroe; scientific secretary: J. de Kleuver



- SAC members: G. Anton, J. van der Brand, P. Chadwick, K. Danzmann, K. Ganga, S. de Jong, O. Lahav, M. Lindner, M. Mezetto, M. Pallavicini, S. Troitsky, M. Zito
- SAC mandate: advice and input to the GA on scientific issues
  - SAC can appoint sub-committees; these report to the SAC which takes the input and reports to GA

THE APPEC ROADMAP 2017–2026

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- Science focus: Multi-messenger astrophysics and gravitational waves, neutrino nature and properties, dark matter and dark energy
- Recommendation 6: Neutrino mass and nature
- APPEC supports experiments for direct kinematic measurements of the neutrino mass, as well as double-beta decay experiments that can probe the nature of neutrinos and LNV
- Some of the most competitive: GERDA (^{76}Ge), CUORE (^{130}Te), NEXT (^{136}Xe)

6. Neutrino mass and nature

Despite all previous efforts, some of the neutrino's very fundamental characteristics remain unknown. Notably, these include neutrino mass and whether the neutrino is its own anti-particle or not (in other words, whether it is a Majorana-type particle or a Dirac-type particle). Both of these issues can be explored by studying the beta decay of selected isotopes. Single-beta decay allows direct kinematical inference of neutrino mass; first results from the world-leading KATRIN experiment in Germany are eagerly awaited. The double-beta decay of, for instance, germanium, tellurium or xenon, meanwhile, is used to probe physics beyond the Standard Model in a unique way by searching for decays without neutrinos. This process is only allowed if neutrinos are Majorana-type particles and its observation would not only reveal the neutrino's nature and pinpoint its mass but also demonstrate violation of lepton number.

Among the various experiments worldwide searching for neutrinoless double-beta decay, European experiments such as GERDA (focusing on germanium), CUORE (tellurium) and NEXT (xenon) are some of the most competitive.

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APPEC strongly supports the present range of direct neutrino-mass measurements and searches for neutrinoless double-beta decay. Guided by the results of experiments currently in operation and in consultation with its global partners, APPEC intends to converge on a roadmap for the next generation of experiments into neutrino mass and nature by 2020.

THE DOUBLE BETA DECAY COMMITTEE

- APPEC GA (and SAC) appointed a committee to discuss the searches for the neutrinoless double beta decay and the future of the European programme
- Organisation:
  - Chair: Silvia Pascoli
  - Members: A. Giuliani, J.J. Gomez Cadenas, E. Previtali, R. Saakyan, K. Schaeffner, S. Schönert
- Mandate from the SAC (approved by GA in December 2018):
  - The Double Beta Decay APPEC Committee should advise APPEC on the European (and international) programme in double beta decay physics. It should report to the APPEC SAC, providing an assessment of the current and future scientific opportunities in double beta decay over the next 10 year period. The concrete aims are:

THE DOUBLE BETA DECAY COMMITTEE

- Mandate from the SAC (approved by GA in December 2018):
  - Assessment of existing, planned and proposed technologies and how these compare with one another. The committee should thus first assess the status of ongoing and planned experiments, including major technical challenges and a comparison of their discovery potential. The committee should then assess the potential of proposed and future technologies to probe the inverted mass ordering scenario, and beyond. Here the status of ongoing R&D for next-generation experiments should also be discussed.

  - Discussion of the role of nuclear matrix elements (NME) and of the g_A coupling uncertainties; discussion of other mechanisms for the 0νββ-decay, apart from light Majorana neutrino exchange; discussion of other possible decay modes, and their relevance compared to 0νββ-decay

  - Consideration of existing and future input from other experiments and constraints in neutrino physics (direct mass determinations, neutrino oscillations, cosmology) and at colliders

  - Critical examination of the resources that would be required to ensure scientific advancement and a potential discovery during this timeframe

  - Assessment of the required infrastructure in Europe, including maintenance or upgrades of existing facilities.

  - Assessment of the status and progress of theoretical efforts in NME, and related theoretical efforts.

TIMELINE FOR THE PROCESS (SAC PERSPECTIVE)

SAC meeting in Zurich

Discussion of the mandate draft and the committee members

Mandate approved by GA in December then sent to committee

November 2018

SAC meeting at CERN

Detailed answers to the SAC questions; report on the arXiv

October 2019

August 2018

SAC meeting in Zurich

Discussions re: bb-committee and objectives; LB was asked to prepare a draft for the mandate

June 2019

Talk by Silvia Pascoli

Written report from committee

Community 0νββ-workshop

Next: SAC meeting in Zurich, Nov 26

AIMS OF THE WORKSHOP

- Discuss and collect the input of the community on the document prepared by the Double Beta Decay APPEC Committee for the APPEC SAC on the future neutrinoless double beta decay experimental programme in Europe
- Goal: maintain a leading role in this scientifically important quest, in line with APPEC Roadmap recommendations
- Assess the existing, planned and proposed technologies, their discovery potential and technical challenges
- Make a critical examination of resources and schedules. We will also review the theoretical issues and the status and uncertainties on the nuclear matrix element evaluation

APPEC Community Meeting on Neutrinoless Double Beta Decay

Hallam Conference Centre, 44 Hallam Street,
W1W 6JJ London
31 Oct 2019

https://indico.cern.ch/event/832454/

APPEC

Double Beta Decay APPEC Commitee

Silvia Pascoli (Chair, Durham U.)
Andrea Giuliani (CNRS/IN2P3)
J.J. Gomez Cadenas (DIPC)
Ezio Previtali (Milano-Bicocca),
RubenSaakyan (UCL)
Karoline Schaner (GSSI)
Stefan Schonert (TUM)

Durham University

IP3

https://arxiv.org/abs/1910.04688

- A big thank you to the double beta committee for the efficient and large amount of work that went into the report, and into answering questions from the SAC
- In particular also to Silvia Pascoli for organising the work and several committee meetings, for reporting to the SAC, and for putting together this important meeting that brings together the community interested in neutrino physics
- Enjoy the talks and the discussions