

*25 May 2020*

- APP contributions to EPPSU:
  - Written Input from APPEC;
  - PPG work (S. Bentvelsen Marco Zito)
  - In Granada Symposium in May 2019
  - In Briefing Book (e-Print: [1910.11775](https://arxiv.org/abs/1910.11775)).
  - **Overall many APP scientific inputs!**
- APPEC Chair observer in ESG and invited to Restricted Council Sessions.
- Active member in ESG-WG3 (relation of CERN with other bodies), WG1 (social and career aspects), WG5 (public engagement, education, communication) WG4 (knowledge & Technology Transfer).
- Participated to Bad Honnef week to draft the strategy document in Jan 2019.
- After January APPEC was blind to the process...(not invited to restricted Council or ESG)
- ESG work **concluded officially on May 25.**
- A **draft Resolution on the EPPSU** is being discussed.
- Document will become public after June 19 Council meeting.
- Any comment on the porcess?

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### EXTRAORDINARY CLOSED COUNCIL

#### DIRECTOR GENERAL'S REPORT

The Council heard an oral report by the Director-General on the status of the Organization since the site and facilities had been placed in “safe mode” on 20 March 2020, and on the comprehensive measures being taken at present to ensure a gradual, cautious and safe restart.

#### DRAFT UPDATE OF THE EUROPEAN STRATEGY FOR PARTICLE PHYSICS

The Council heard a report by the Strategy Secretary, Professor H. Abramowicz, addressing the matters raised by delegations on the proposed Strategy update at and since the Session in March 2020, expressed its appreciation to her and everyone involved in the Strategy update process and agreed that the work of the European Strategy Group and its subsidiary bodies was now complete.

The Council then discussed a draft Resolution on the update of the European Strategy for Particle Physics and invited the President's Group to make a number of amendments to it and to submit the revised version for consideration in June.

# APPEC procedure for roadmap implementation on $0\nu\beta\beta$ decay

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- SAC charged a panel (led by Silvia Pascoli) with mandate to describe the status of major experimental efforts in Europe also in relation to international context and synergy with other fields (such as for DM direct detection).
- Panel's document sent to SAC on Jun. 17 and S. Pascoli presented the document at the SAC Jun. 18-19 meeting.
- Comments from SAC received on July 4 and implemented
- Document released in the archive on Oct. 19 in <https://arxiv.org/pdf/1910.04688.pdf>
- APPEC sponsored the Community meeting (<https://indico.cern.ch/event/832454/>, London, Oct 31, 2019 (LOC R. Sakyaan, S. Pascoli))
- Process in APPEC newsletter <https://www.appec.org/news/neutrinoless-double-beta-decay-report-from-the-appec-committee>
- On SAC Nov 26 meeting, SAC endorsed 6 recommendations of the panel and and **concluded** (from minutes):
  - *We endorse the scientific review carried out by the committee to summarize the main European efforts in neutrino less double beta decay.*
  - *We encourage the community to explore convergence towards 2-3 technologies with the potential to be scaled up to the ton scale (and beyond).*
  - *We strongly endorse the importance of neutrinoless double beta decay searches. **There should be at least two large experimental programmes globally, and at least one hosted in Europe.***
  - *This evaluation **should be updated in 4 years**, reflecting what is learned in the meantime from technology demonstrations, what we learn about normal vs. inverted hierarchy from neutrino oscillation experiments, and the international funding situation.*
  - *We endorse **R&D towards new technologies** to reach the normal hierarchy and for new physics searches.*

# APPEC procedure for roadmap implementation on 0nubb decay

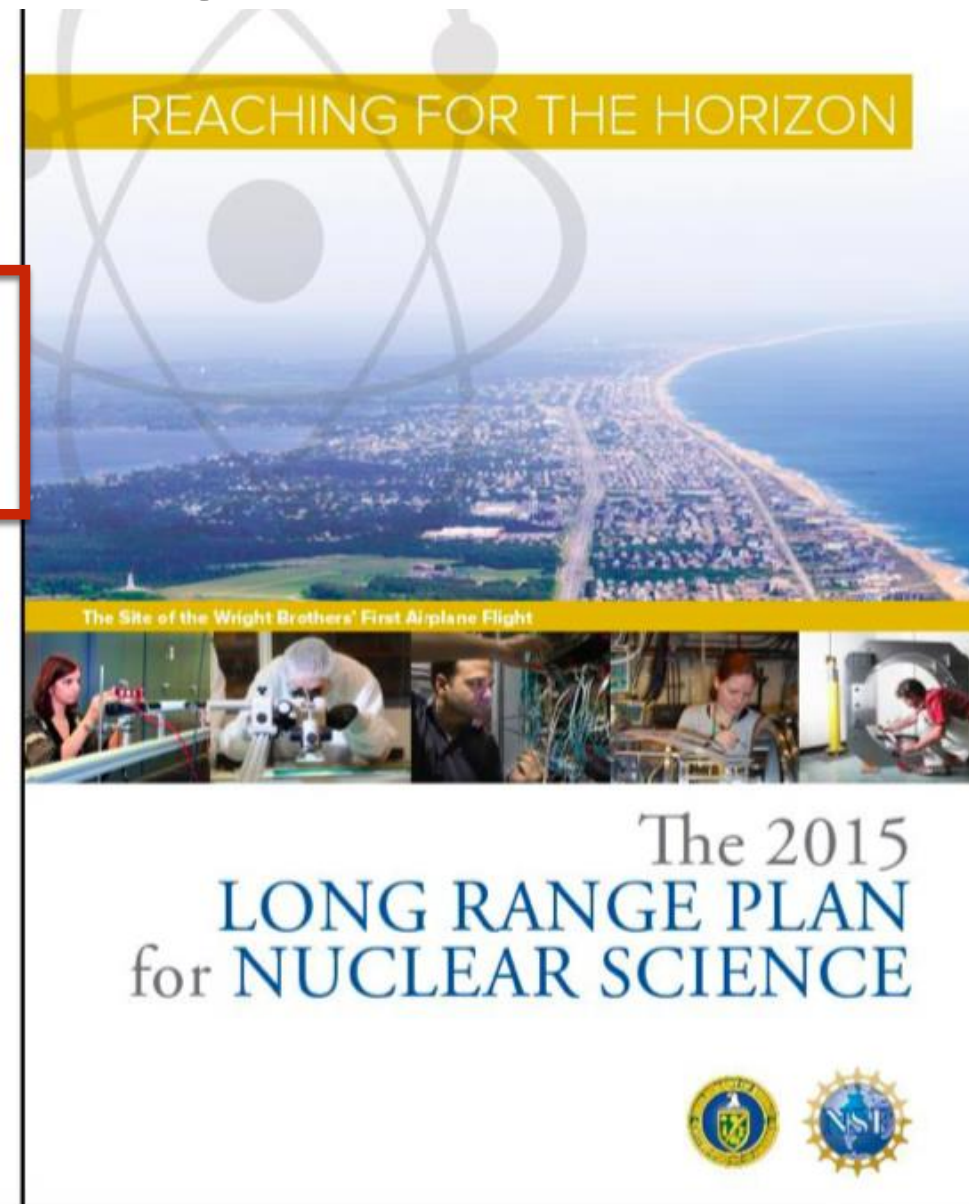
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- At Meeting Dec. 2-3, 2019, GA agreed on the SAC recommendations (from minutes):
  - APPEC-GA **endorses the scientific review carried out by the committee** to summarize the main European efforts in neutrinoless double beta decay.
  - APPEC-GA encourages the community to explore convergence towards **2-3 technologies with the potential to be scaled up to the ton-scale (and beyond)**.
  - APPEC-GA strongly endorses the importance of neutrinoless double beta decay searches. There should be **at least two large experimental programmes globally, and at least one hosted in Europe**.
  - This **evaluation should be updated in 3-4 years**, reflecting what is learned in the meantime from technology demonstrations, what we learn about normal vs. inverted hierarchy from neutrino oscillation experiments, and the international funding situation.
  - **APPEC-GA endorses R&D towards new technologies** to reach the normal hierarchy and for new physics searches.
  - APPEC-GA endorsed the panel recommended for a more active coordination role from the largest of the underground laboratories.
- Chair organise follow-up to develop a common EU view and contact DOE
- New version of document approved by SAC and GA in the archive in Feb. 2020.
- April 21 Chair message to T. Hallmann summarising the process and also responding to NUSAC comments on being the document too 'eurocentric' (no nEXO community able to escalate at national funding level today in Europe and strong US participation in CUPID and LEGEND experiments at CDR level of advancement as well as liquid and gaseous noble gas needing more coordination with DOE)
- Response on June 1: the main thing to report is that at present, **R&D continues on the most promising “front-runners”** for technologies to be considered for a ton-scale DBD measurement (LEGEND-1000, nEXO, CUPID, NEXT).
- Latifa Eloudhiri, Jehanne Gillo in charge for plans on an **international meeting (in June to August 2020)** to discuss possible sites for a ton-scale experiment that might have major participation from the U.S. and its international partners. Request to identify interested parties from APPEC side.

# Neutrinoless double beta decay in US

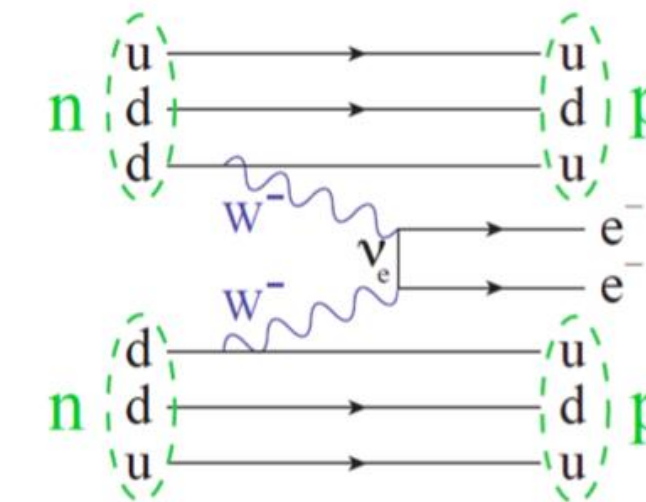
## Recommendations of 2015 long range plan:

1. Capitalize on investments made to maintain U.S. leadership in nuclear science.
2. Develop and deploy a U.S.-led ton-scale neutrino-less double beta decay experiment.
3. Construct a high-energy high-luminosity polarized electron-ion collider (EIC) as the highest priority for new construction following the completion of FRIB.
4. Increase investment in small-scale and mid-scale projects and initiatives that enable forefront research at universities and laboratories.



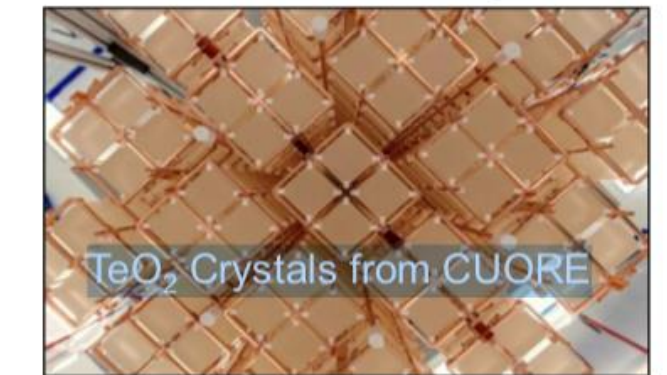
How can it be determined whether the neutrino is a Majorana Particle?

Search for Neutrino-less Double Beta Decay ( $0\nu\beta\beta$ ): in a selected nucleus, two neutrons decay into two protons and two electrons, with no neutrinos being emitted.



It can only happen if the two neutrinos from the two  $W^-$  particles annihilate internally because the neutrino is its own anti-particle

Scientists have been eagerly working to demonstrate the necessary sensitivity



TeO <sub>2</sub> from CUORE and CUOREcino	1.5 × 10 <sup>25</sup> years, 90% CL
Ge <sup>76</sup> from Majorana Demonstrator	1.9 × 10 <sup>25</sup> years, 90% CL
Ge <sup>76</sup> from GERDA	8.0 × 10 <sup>25</sup> years, 90% CL
Xe <sup>136</sup> from EXO-200	1.8 × 10 <sup>25</sup> years, 90% CL
Xe <sup>136</sup> from Kamland-Zen	1.1 × 10 <sup>26</sup> years, 90% CL

FY 2020 Enacted: \$1M

FY 2021 Request: \$1.44M

- DOE proceedings: down selection of site (SNO Lab in pole position) and down selection of a ton-scale US-led experiment with international participation and another project.
- Discussions on  $0\nu\beta\beta$  decay in WG9 of IUPAP on Nuclear Physics (David Hertzog NSAC Chair and Nigel Smith in charge of low-E neutrinos). WG10 (ApPIC, Chair Natalie Roe, not active since 2018) on APP...should be in continuous dialogue with APIF of Global Science Forum and advice it. WG11 is GWIC.
- Berrie Giebels (IN2P3) APPEC representative in Snowmass 2021 process (Division of Particle and Fields chair Young-Kee Kim, see <https://snowmass21.org>)

# For discussion

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- 1) International Meeting: will EC agencies coordinate before a meeting or let US take the lead without a clear path?
  - send a list of representatives of agencies of involved countries and delegated scientists from experiments with leading roles in APPEC (G, IT, Fr, UK, Russia, PL, CH, CzR);
  - align agencies APPEC agencies first in Eu for an effective participation in a dedicated virtual meeting in the next few weeks;
- 2) The Onubb decay panel recommended more active coordination role from the largest of the underground laboratories. The DM panel has echoed this request which find large consensus from communities: network of EC labs represented by a legal agency, eg an ERIC European Laboratory of Underground Science
- 3) Revive discussion with ApPIC and APIF. We need an international forum of APP Agencies!