Proposal for a plan leading to the implementation of the new generation of neutrinoless double beta decay

The study of neutrinoless double beta decay is recognized in the European and North American scientific communities as fundamental for the exploration of the nature of the neutrino mass and of lepton number violation.

Having realized that a new generation of experiments is ready to start their implementation, the Northern American and European funding agencies aim at consolidating their efforts in order to address the 10-20 meV mass scale of the lightest neutrino and fully explore the inverted ordering region of the neutrino mass pattern. At least two experiments are targeted at international level with capability of covering the inverted mass scale with energy resolution better than ~0.2% at $Q_{\beta\beta}$ and background at the level of 10^{-4} counts keV^{-1} kg^{-1} yr^{-1}. Additionally, R&D towards the future challenge of the exploration of the normal hierarchy region has to be continued in order to reach near-to-zero background in the tens of tons scale.

The field benefits from aligning international agencies in order to achieve a different isotope program exploiting different technologies with proven capability of controlled systematic errors, to ensure timely validation of of results. Three isotopes, ^{100}Mo, ^{76}Ge and ^{136}Xe, offer possible implementations and a high degree of readiness to achieve appropriate sensitivity to cover the 10 meV region. Correct interpretation of results will be achieved through a dedicated global theoretical and experimental effort, via close collaboration with the nuclear physics community led in Europe by NuPECC and the DOE Nuclear Physics Program in the USA. An essential element of this collaboration must be a coordinated effort to achieve a more accurate determination of the Nuclear Matrix Elements.

The agencies that may participate are committed to a fair and science-driven process, involving the experimental and theory experts in the European and North American communities, who aim to fulfill community-driven Roadmap recommendations for neutrino science. In Europe this effort is led by APPEC and is summarized in the SAC Panel document in the archive. While in Europe, various funding agencies align the aim in this field in the frame of APPEC, in the USA the process is led by the DOE Nuclear Physics Program. The HEP neutrino community is expressing their scientific goals through the Snowmass process, followed by the P5 recommendations. The DOE Nuclear Physics Program is following the recommendations of the 2015 Long Range Plan for Nuclear Science: *Reaching for the Horizon*. The APPEC framework, implementation of the DOE Nuclear Physics Long Range Plan and Snowmass need to ensure that the liason between proposed projects for neutrinoless double beta decay and direct detection of dark matter projects are strongly connected by common expertise in technologies and methods. This is required, given the scale of current efforts, as well as to prepare the appropriate level of synergy to achieve normal hierarchy coverage in a time frame of 10-20 years.

With this view, a joint strategic plan is proposed to be developed between the European agencies and North American ones with the aim of ensuring a fair program with global best value return, also achieved through considerations on the hosting sites of the projects. In this respect, considerations have to be made on the background reduction level related to depth, which eventually has to be addressed by appropriate instrumental vetoes. Additionally, considerations on infrastructure and costs, schedules and risks, best value towards future generation have to be addressed by appropriate level of readiness, normally ensured by detailed TDR.

The strategy foresees:

- A joint preparatory meeting of APPEC interested agencies to happen virtually after the GA before mid January with DOE with aim of electing a steering board for the preparation of the 2021 $0\nu\beta\beta$ European-North American Summit and define its mandate including the Big Questions that the Summit should address.
- The Steering Board will define the Scientific Program and consult eventually panels and experts in North America by mid February 2021.
- The Summit is organized in Europe, with date to be fixed by mid December 2020, possibly at LNGS and/or virtually before the end of May. The goal of the meeting will be to achieve collectively a global investment strategy for the achievement of at least 2 projects for the 10-20 meV reach.
- Virtual wrap up agency meeting by July 2021 summarized in a joint resolution document signed by Funding Agencies.