

# XeSAT2022 - International Workshop on Applications of Noble Gas Xenon to Science and Technology



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## Invited: Searching for Majorana neutrinos with nEXO, Andrea Pocar

*mardi 24 mai 2022 15:30 (30 minutes)*

nEXO will search for neutrinoless double beta ( $0\nu\beta\beta$ ) decay in 5 tonnes of xenon enriched to 90% in the  $\beta\beta$ -decaying isotope xenon-136 [1]. The observation of  $0\nu\beta\beta$  decay would imply lepton number non-conservation of an otherwise conserved quantity in nature. At the same time, it would require neutrinos and anti-neutrinos to be the same particle, i.e., a Majorana fermion, a unique property among fundamental particles of the Standard Model. The observation of  $0\nu\beta\beta$  decay could occur via different underlying microphysics. A unique mass mechanism exists for Majorana particles that could explain why neutrinos are so light and link the neutrino mass with the  $0\nu\beta\beta$  decay rate.

nEXO operates with 5 tonnes of liquid xenon (LXe) in single-phase in a cylindrical time-projection chamber (TPC) with diameter and height of about 1.3m [1]. The nEXO TPC measures the energy, position, and topological multiplicity of each event. By the simultaneous event-by-event detection of ionization and scintillation nEXO will have an anticipated energy resolution of better than 1% at the  $\beta\beta$  endpoint with a projected  $0\nu\beta\beta$  decay half-life sensitivity of  $1.35 \times 10^{28}$  years (90%CL) after 10 years of lifetime [2].

The ionization electrons are recorded by a segmented anode plane at one end of the TPC [3]. The prompt VUV scintillation photons (175 nm) are recorded by a  $\sim 4.5\text{m}^2$  array of VUV-sensitive silicon photomultipliers (SiPMs) mounted on the cylinder barrel surface [4]. Both detection systems will be immersed in the LXe, along with the front-end readout electronics. An extensive nEXO R&D program has focused on two SiPM options: VUV4 Multi-Pixel Photon Counter (MPPC) from Hamamatsu Photonics Inc. (HPK) and VUV-HD SiPM from Fondazione Bruno Kessler (FBK). Both devices meet nEXO's requirements. Integration of SiPMs into larger modules is currently being detailed.

The status of nEXO's photodetector and charge readout system will be presented along with measured performance parameters and a general overview of the nEXO technology.

### References

- [1] nEXO Collaboration (S. Al Kharusi, et al.), arXiv:1805.11142v2 (2018)
- [2] nEXO Collaboration (G Adhikari et al.), J. Phys. G: Nucl. Part. Phys. 49, 015104 (2022).
- [3] nEXO Collaboration (Z. Li, et al.), JINST 14, P09020 (2019)
- [4] nEXO Collaboration (G. Gallina, et al.), NIMA 940, 371 (2019)

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