Contribution ID: **352** Type: **Invited Presentation**

Neutrinoless Double Beta Decay: Where We Stand and What Lies Ahead

Neutrinoless double beta decay ($0\nu\beta\beta$) is a key process in understanding the fundamental nature of neutrinos and their role in the evolution of the Universe. Following the discovery of neutrino flavor oscillations, which demonstrated that neutrinos have mass, the search for $0\nu\beta\beta$ has become one of the most compelling challenges in contemporary particle physics. This talk will begin with an overview of the deep connections between neutrino properties and the mechanism of neutrinoless double beta decay, emphasizing its implications for lepton number violation and the Majorana nature of neutrinos.
The presentation will then survey the most sensitive experimental strategies employed to detect this rare nuclear process, highlighting current efforts across various technologies. A comparative overview of running experiments will be provided, focusing on detector concepts, background suppression techniques, and scalability toward next-generation experiments. The current status of experimental limits on the effective Majorana neutrino mass will be discussed, along with the potential of upcoming projects to cover the inverted mass hierarchy region and a large fraction of the normal one. The talk will conclude with a perspective on future directions and the roadmap toward a definitive discovery.

Author: Dr NONES, Claudia (CEA/IRFU/DPhP)

Presenter: Dr NONES, Claudia (CEA/IRFU/DPhP)

Session Classification: Plenary Session

Track Classification: Astroparticle Physics and Synergies with Nuclear Physics