

Neutrino physics



Fréjus Tunnel, Modane
depth: 1.7 km

SuperNEMO NEUTRINO ETTORE MAJORANA OBSERVATORY

Knowing if the neutrino is identical to its antiparticle

© SuperNEMO Collaboration

- **Scientific leader:** Laurent Simard (IJCLab) *
- **Laboratories involved:** CPPM (Marseille), IJCLab (Orsay), LAPP (Annecy), LP2I (Bordeaux), LPCC (Caen).
- **Nature:** research infrastructure
- **Status:** International project at the end of its installation at the LSM, involving 21 institutions from 9 countries (United States, Finland, France, Great Britain, Japan, Czech Republic, Russia, Slovakia, Ukraine)
- **Website:** <https://supernemo.org>

SCIENTIFIC OBJECTIVES

The SuperNEMO demonstrator is to validate a new method to search for double beta decay without neutrino emission. The observation of this process would prove that the neutrino is a Majorana particle, identical to its antiparticle. This would constitute an important avenue of research beyond the Standard Model. The detector permits a complete reconstruction of the emitted particles, which allows a very efficient rejection of the background noise and a precise characterisation of the decays.

RESOURCES DEPLOYED

At its centre the detector contains a thin panel of very pure Selenium enriched in ^{82}Se , 12 m^2 in area and less than half a millimetre thick. This serves as a double beta radioactive source. On either side of this source, detectors (a wire chamber operating in the Geiger regime and a calorimeter composed of scintillating plastic blocks coupled to low-radioactivity photomultipliers) capture all the particles emanating from the Selenium. The selection of very low radioactivity materials for the detector and effective shielding ensures a very low background level.

The detector is **1 000** times less radioactive than the human body (for the same mass)

9 participating countries **21** research institutes

48 m^3 : volume of the detector

4×10^{24} years: expected limit after 2.5 years in the absence of a signal on the half-life of the phenomenon

IN2P3 CONTRIBUTIONS

- Responsible for the mechanical construction of the calorimeter and the design, manufacture and testing of the associated electronics
- Responsible for the installation of the demonstrator at the LSM
- Responsible for the manufacture of the sources
- Measurement of the radioactivity of the components
- Technical responsibility for SuperNEMO
- Analysis of data from the predecessor detector, NEMO-3



* Since 2021