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Report on SuperNEMO project

The search of neutrinoless double beta decay ($\beta\beta(0\nu)$) is presently the most sensitive process to determine the nature of the neutrino. It could be a Majorana particle (in this case neutrino and anti-neutrino are the same states) or a Dirac particle (neutrino and anti-neutrino are different states). This property is essential for the scenario of leptogenesis for the creation of the matter in the early Universe requiring that neutrino are Majorana particle.

The SuperNEMO detector is based on the detection of the two emitted electrons. It consists in a central thin source foil sandwiched by two tracker volumes surrounded by a calorimeter to measure the energy of the electrons. This « tracko-calo » technique has several unique features: possibility to measure several isotopes, to identify the emitted electrons in order to reduce drastically the background, to measure the background using several analysis channels and to measure all kinematic parameters allowing potentially to determine the process leading to ($\beta\beta(0\nu)$) decay in case of discovery.

The SuperNEMO detector is the following of the NEMO series of detector. The successful NEMO3 detector has allowed to measure simultaneously seven double beta decay isotopes and has obtained the best half-life limit $T_{1/2} > 1.2\ 10^{24}$ years for the for ^{100}Mo leading to a neutrino mass limit $<m_\nu> <$ 0.3 -0.5 eV with only 7 kg of isotope and 5 years of data.

The SuperNEMO experiment is based on the same principle but has a planar geometry compared to the cylindrical geometry of NEMO3. The collaboration has reduced the background sources (in particular radon) and improve by a factor two the energy resolution (4% FHWM at 1 MeV compare to 8% in NEMO3). The full experiment would be made of 20 modules containing 5 kg of isotope to reach of total mass of 100 kg. A demonstrator accommodating 7 kg of ^{82}Se has been built and the installation is in progress at the Modane Underground Laboratory. The data taking is scheduled for mid-2018. It is expected to have no background in the Region of Interest. The expected sensitivity for two years and half of data is expected to be $T_{1/2} > 5.9\ 10^{24}$ years corresponding to an effective neutrino mass $<m_\nu> <$ 0.2 -0.5 eV. A R&D program will continue to improve the detector in order to built 20 modules to reach an exposure of 500 kg.yr.

The JINR has very crucial contributions in the SuperNEMO experiment : procurement of 1.5 kg of enriched ^{82}Se, purification of 3.5 kg of ^{82}Se with a method develop by JINR, procurement of plastic scintillators (60) and photomultipliers (100 8'') for the calorimeter, electronics crates, production of cables for the tracker and two ultra-low background germanium gamma spectrometers to select materials and measure residual source contaminations. JINR is also involved in the software of the SuperNEMO.

The SuperNEMO experiment will be one of the most promising competitor for the search of neutrinoless double beta decay with the unique capability to recognize the 2 emitted electrons in the process. The JINR Dubna has very visible and essential contributions in this experiment with more than 5 implied FTE.

In conclusion, I strongly recommend to support the SuperNEMO program.

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