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CANDLES : Low background double beta decay experiment using Ca48

The discovery of neutrino less double beta decay implies important physics related to the origin of matter: the Majorana nature of neutrinos and the lepton number violation. It can also reveal the absolute value and hierarchy of neutrino masses. Neutrino less double beta decay is considered to be a very rare phenomenon, requiring an extremely low background environment and a large number of target nuclei.

CANDLES is an experiment to study the double beta decay of Ca48 in a CaF2 scintillator. 48Ca has the largest Q-value among the double beta decay nuclei and is a highly background tolerant nucleus. Double magic number nucleus, Ca48, is also the lightest double beta decay nucleus. Therefore, it is suitable for the calculation of nuclear matrix element by shell model, and it is considered to be an interesting target for double beta decay search.

We have constructed a CANDLES-III detector with 305 kg of undoped CaF2 scintillator crystals at Kamioka underground observatory in Japan. We have achieved a background level of 10^−3 events/keV/yr/(kg of nat.Ca) in the Q-value region, by 4 pi active shielding using liquid scintillator together with efficient gamma-ray shielding by lead and neutron shielding by boron. This is comparable to other low background and sensitive experiments. In this talk, we will report on the results of the pilot run of CANDLES-III with natural Ca, including the obtained detector performance and the neutrino less double beta decay search experiment. In addition, the current status of R&D for future scintillating bolometers using CaF2 and isotope enrichment will be reported.

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