HAW09-2009-000213

Abstract for an Invited Paper
for the HAW09 Meeting of
the American Physical Society

CANDLES for the study of ^{48}Ca double beta decay

IZUMI OGAWA, Graduate School of Science, Osaka University

CANDLES is the project to search for double beta decay (DBD) of ^{48}Ca by using CaF_2 scintillators. The Q-value of ^{48}Ca, which is the highest (4.27 MeV) among potential DBD nuclei, is far above energies of γ-rays from natural radioactivities (maximum 2.615 MeV from ^{208}Tl decay), therefore we can naturally expect small backgrounds in the energy region we are interested in. We gave the best lower limit on the half-life of neutrino-less double beta decay of ^{48}Ca by using CaF_2(Eu) detector system, ELEGANT VI though further development is highly desirable to reach the mass region of current interest. We have constructed the prototype detector, CANDLES III in our laboratory (Osaka U.) at sea level and studied the basic performance of the system, including the light collection, position reconstruction and background rejection. We are now moving the detector system to new experimental room (room D) at Kamioka underground laboratory (2700 m.w.e.) to avoid large background originated from cosmic rays. At the same time, we are increasing the total mass of the ^{48}Ca compared to the one in the prototype detector. 96 (instead of 60 in prototype) CaF_2 modules which contains 350 g of ^{48}Ca are immersed in a liquid scintillator (LS) which acts as an active veto (veto phase). The conversion phase contains wavelength shifter (Bis-MSB) which converts the emission light of CaF_2(pure) which has a peak in the UV region to the visible one where the quantum efficiency of the PMTs is high enough (maximum at $\sim$ 400 nm) and materials at the optical path have good transparencies. Scintillation lights from both the CaF_2 modules and the liquid scintillator in veto phase are viewed by large PMTs (48×13" and 14×17" tubes). All the detector system described above are contained in a water tank which is 3 m in diameter and 4 m in height. The water tank and a purification system of the LS together with LS storage tanks were installed at room D. The purification system of the LS removes the radioactive impurities especially U and Th using the techniques of water-extraction and N_2 purge. Other components including the CaF_2 modules, the PMTs, the liquid scintillator vessel and DAQ system will be installed soon.