

Study of Double Beta Decay of ^{48}Ca

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【Outline of survey】

Recent demonstration of neutrino oscillation shows that there are mass difference between different neutrino species although no definite value is given to neutrino mass itself. Therefore observation of neutrino-less double beta ($0\nu\beta\beta$) decay, which gives Majorana mass of neutrino, becomes particularly important. Observation of $0\nu\beta\beta$ decay is a result of neutrino to anti-neutrino transition thus demonstrates the violation of particle number which is believed to hold without any foundation. Its observation is a key to understand the matter dominated universe.

Current best sensitivity is given by the study of ^{76}Ge although its relatively small Q value (2.04 MeV) makes the future study difficult due to radioactive backgrounds. In the present research project we study $0\nu\beta\beta$ of ^{48}Ca which has the highest Q value among all $\beta\beta$ decay nuclei. The highest Q value should be a key to reduce background and we will overtake the current ^{76}Ge experiment by constructing CANDLES detector at underground laboratory.

【Expected results】

Once we demonstrate that CANDLES detector works, we will have a detector system which enables us to sense the neutrino mass region beyond the ^{76}Ge experiment. Currently the ^{76}Ge experiment shows the best sensitivity although we also see its limit due to radioactive backgrounds. CANDLES can be a new detector to replace. If we can observe $0\nu\beta\beta$ decay in the present study, neutrino is shown to have Majorana mass and lepton number conservation is violated. Its demonstration is a key to explain why our Universe is matter dominated. The CANDLES detector has a design of easy scale up therefore we can design future detector based on CANDLES.

【References by the principal researcher】

CANDLES for the study of $\beta\beta$ decay of ^{48}Ca
T. Kishimoto, et al., Proceedings of 4th International Workshop on Neutrino Oscillation and their Origin (NOON2003) Kanazawa, Japan, 10-14 February 2003, (2004), 338-349
Search for neutrino-less double beta decay of ^{48}Ca by CaF_2 scintillator
I.Ogawa, et al., Nucl. Phys. A730 (2004) 215-223

【Term of project】 FY 2005 - 2009

【Budget allocation】 84,800,000 yen

【Homepage address】

http://wwwkm.phys.sci.osaka-u.ac.jp/info/syoukai/CANDLES_project.htm