

博士論文公聴会の公示(物理学専攻)

学位申請者：角畑 秀一

論文題目：**Study of Backgrounds in CANDLES to Search for Double Beta Decays of ^{48}Ca**

(^{48}Ca の二重ベータ崩壊探索のための CANDLES におけるバックグラウンドの研究)

日時：2015 年 5 月 19 日 (火) 13:00–14:30

場所：理学研究科H棟 7 階セミナー室 (H701 号室)

主査：岸本忠史

副査：山中卓、野海博之、能町正治、吉田斉

論文要旨:

CANDLES is a series of experiments to search for $0\nu\beta\beta$ decay of ^{48}Ca . Currently the CANDLES III(U.G.) detector is running. The aim of the present study is to clarify origin of backgrounds that limits the sensitivity of the current system. Due to the high $Q_{\beta\beta}$ (4.27 MeV) of ^{48}Ca , conceivable background sources are limited. Thorium-chain nuclei contaminated in CaF_2 crystals were known backgrounds. We developed methods to reduce them to be negligible for the current sensitivity. However, unknown backgrounds at the $Q_{\beta\beta}$ region were still observed. Sensitivity of CANDLES with such backgrounds for $0\nu\beta\beta$ half-life is 0.8×10^{22} year or longer which is much worse than the preceding experiment of ELEGANTS VI. In order to improve the sensitivity, background free measurement should be achieved. Therefore we studied the origin of backgrounds. Observed spectra suggest that these backgrounds come from γ -rays from (n,γ) reactions in materials around the detector. We performed experiments using ^{252}Cf neutron source. The results are consistent with the obtained backgrounds in the $Q_{\beta\beta}$ region. We concluded that the backgrounds are from the (n,γ) reactions. Based on this study we are able to clarify that additional outer shields against γ -rays and neutrons are most effective to improve the current sensitivity. The shield was designed to realize less than 1 background event per year. This background level makes half-life sensitivity of the detector longer than 10^{24} year, which can give the most stringent experimental limit for $0\nu\beta\beta$ of ^{48}Ca .