# 博士論文公聴会の公示（物理学専攻）

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**論文題目：**Background Reduction Techniques for Neutrinoless Double Beta Decay Search at CANDLES Experiment

（CANDLES 実験におけるニュートリノレス二重ベータ崩壊探索のバックグラウンド除去技術）

**日時：** 2020 年 2 月 7 日（金） 16:20 － 17:50

**場所：** 理学研究科 H 棟 7 階セミナー室（H701 号室）

**主査：**川畑貴裕

**副査：**山中卓、能町正治、岸本忠史、梅原さおり、吉田斉

**論文要旨：**The neutrinoless double beta decay(0νββ) is a currently unobserved decay in which two neutrons simultaneously decay into two protons and two electrons without any emitted neutrinos. This is a lepton number violating decay and it is only allowed if the neutrino is a Majorana type particle. Thus the observation of 0νββ confirms the Majorana nature of the neutrino as well as provide clues to leptogenesis and the absolute mass scale of the neutrino. The expected half-life of the decay is on the order of $10^{27}$ years.

The CANDLES(CAlcium fluoride for studies of Neutrino and Dark matters by Low Energy Spectrometer) experiment is looking for 0νββ using $^{48}$Ca isotope contained in scintillating $CaF_2$ crystals. Because the natural abundance of $^{48}$Ca is about 0.2%, an extremely low background detector is required to observe 0νββ.

The main source of background in the 0νββ signal energy region comes from the decay of $^{212}$Bi, which is a natural background occurring due to contamination of the $CaF_2$ crystals. The $^{212}$Bi has an α and β decay channels, both of which deposit backgrounds in the Q value region of 0νββ. In this study, two new methods were developed to reduce the backgrounds from these decay channels. Of interest is the application of neural network method for physics data analysis. The neural network developed in this study is shown to improve background rejection efficiency over traditional methods. The new methods were used to reject backgrounds with good efficiency and the remaining background counts were estimated.