

## 博士論文公聴会の公示（物理学専攻）

学位申請者： 李 曉龍

論文題目：Study of a Large Volume CaF<sub>2</sub>(Eu) Scintillating Bolometer with Metallic Magnetic Calorimeter.

（大型 CaF<sub>2</sub>(Eu)シンチレーション結晶と金属磁気熱量計を用いた熱量蛍光検出器の研究開発）

日時： 2020年2月6日（木） 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：川畑貴裕

副査：岸本忠史、梅原さおり、嶋達志、酒井英明、吉田斉

論文要旨：

Neutrinoless double beta (0νBB) decay is a way to prove fundamental properties of neutrinos, such as Majorana nature, mass hierarchy and absolute mass scale. Our experiment group plans to develop a scintillating bolometer to search for the 0νBB decay of <sup>48</sup>Ca.

We established a large scintillating bolometer using a 312 g CaF<sub>2</sub>(Eu) crystal with a readout technology of metallic magnetic calorimeters. A set of successful measurements were carried out for simultaneous detection for heat and light signals at a few 10 mK in an above-ground laboratory. The comparison of relative amplitudes of heat and light signals obtained about 10 σ discrimination power. The resolution of scintillation signals was 3.1% for 4.9 MeV alpha events, so we can estimate that the same energy beta/gamma events should have 1.3% energy resolution because of a 17% quenching factor. The resolution exceeded the current running CANDLES experiment's 2.5%.

The intrinsic resolution of phonon signals was 0.3% (FWHM) at 5.6 MeV. However, we also found the phonon signals experiencing strong position dependence. This position dependence can be interpreted by the spin-lattice interaction of paramagnetic Eu ions in the CaF<sub>2</sub> crystal.