

2019 (令和元) 年度 共同利用研究・研究成果報告書

研究課題名 和文：XENONnT 実験の研究開発及び暗黒物質探索

英文：Research and development for XENONnT and search for dark matter

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研究成果概要

This progress report below is subdivided into two segments, following the two main subjects in our proposal. Support granted to us by the Kyodo-Riyo system for the Kamioka Observatory played an important role in achieving our goals and enabling successful and timely completion of the various tasks. In particular our grant supported a very important face-to-face meeting that for extraneous reasons had to be scheduled at Kashiwa.

1.) XENONnT neutron veto related achievements:

Kamioka Observatory technology is the foundation on which the XENONnT neutron veto (nVeto) is built, and here supporting access of our members to the observatory is crucial. There are two important aspects to this statement: the Kamioka expertise with handling and sourcing clean gadolinium sulfate, and importantly access to the Super-Kamiokande/EGADS expertise relevant for establishing, monitoring and maintaining a water transparency that will allow the XENONnT nVeto to meet expectations in terms of efficiency.

Monitoring the water transparency will be a key to success, and at Kamioka we developed the protocol and the device to achieve the necessary precision based on a modified commercial spectrometer. The measurements made with this device and protocol already played a crucial role in deciding the sources for the gadolinium sulfate to be used for the XENONnT nVeto, with the majority of it coming from the same source as used for SK-Gd.

2.) XENONnT liquid xenon purification related achievements:

A material contribution to the XENONnT liquid purification (LPUR) system from Japan is its purity monitor. This is an important LPUR element designed to continually measure and thus monitor LPUR performance throughout all of XENONnT data taking. It was designed, built, and tested at Kamioka, with the tests making use of the liquid xenon facilities underground in Lab C at the Observatory. The instrument achieved the required resolution to measure the expected millisecond electron lifetime and is now installed and working at XENONnT.

In conclusion Kyodo-Riyo support in FY2019 helped us to achieve all our aims related to hardware. Since no data were taken with the XENONnT detector yet, our dark matter searches are still pending, but our members are now involved in preparing for analysis and developing the software needed to start analysis as soon as first data arrive. Our readiness here also owes to this Kyodo-Riyo grant in particular and Kamioka Observatory support in general. To both: Thank you for your support, below as well as above ground!

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