Research Report
ICRR Inter-University Research Program 2020

Research Subject:

Research and Development for XENONnT and future Dark Matter searches

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Summary of Research Result :

During FY2020 the XENONnT experiment at LNGS, Italy's underground laboratory, entered its commissioning phase, and our Japanese team played important roles in achieving this milestone:

With the help of our purity monitor installed by our student at the experiment in Italy the collaboration has verified the efficiency of the filter material we proposed for liquid xenon purification. During commissioning the detector XENONnT achieved an unprecedented electron lifetime of a few milliseconds in the detector's liquid xenon time projection chamber – a world record and an important ingredient for the upcoming successful science runs!

The neutron veto also started operating successfully during this commissioning phase, but so far only with pure water. The COVID-19 pandemic delayed the delivery of the purification system for gadolinium loaded water from our supplier in the US, who also provided the EGADS system at Kamioka. It is this, EGAD's Kamioka technology, that the we are bringing to XENONnT. Despite the delays installation on site in Italy will be on time for gadolinium loading when the experimental program for XENONnT requires it.

Using teleconferencing our members keep collaborating and now analyzing XENONnT data from the commissioning phase in preparation for working on science data. We also contributed our knowledge and expertise to the latest XENON collaboration science papers, which are still based on XENON1T data.

Given the continuing COVID-19 pandemic around the world and here in Japan we unfortunately had to achieve the above-mentioned milestones without being able to travel and for the in-person meetings we had planned between us here in Japan to exchange our ideas, review our procedures, and advance our collaboration. As our grant was for traveling, mainly to and from the Kamioka Observatory, we could not actually make use the crucial advantage your kind grant for FY2020 offered us, and we had to ask for it to be carried over into FY2021. It still remains of utmost importance to us to be able to conduct this joint research JOINTLY here at Kamioka to further develop the advantages our technologies bring to our XENONnT experiment and to develop and maintain the personal relationships that build trust and give our younger researchers a better chance to develop their ability.

As members of the XENON collaboration some of us also joined into recent publications of XENON1T research results, in particular the result on an excess of low energy electronic recoil events seen in the XENON1T data.

In summary I think that with XENONnT we are on track to be the first to have a real chance to see dark matter particles interacting in our detector. Thank you for your continued support.

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