RCNP EXPERIMENT E

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE:
Measurement of gamma rays from neutron-oxygen interaction

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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RUNNING TIME: Installation time without beam — 2 days (for each beam time)
Data runs — 2 days

BEAM LINE: Ring : N0 course

BEAM REQUIREMENTS:
Type of particle — proton
Beam energy — 30 and 246 MeV
Beam intensity 111 nA (after frequency division of 1/9)
Other requirements — energy resolution $\leq$ 1 MeV
halo-free, small emittance, beam pulsing
time interval of the proton pulse $\leq$ 800 ns

BUDGET: Experimental expenses — 0 yen

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SUMMARY OF THE PROPOSAL

We propose to measure the characteristics of gamma rays generated in neutron-oxygen interactions using the RCNP monoenergetic neutron beam. This measurement will not only provide fundamental information about gamma-ray emission in such interactions but will also provide essential information for neutrino experiments. The first observation of the neutrino-oxygen neutral current quasi-elastic interaction was reported by the T2K experiment in 2014; the result which is important to supernova neutrino detection, sterile neutrino search, dark matter search experiments, and so on. Observation of the gamma ray generated in the neutrino-oxygen interaction is the primary goal of the T2K measurement. However, these neutrino interactions also produce secondary nucleons, both neutrons and protons, whose subsequent interactions with oxygen nuclei often produce gamma rays that are a background to the primary measurement. Uncertainties in the production mechanism of these backgrounds are a large source of uncertainty in the T2K measurement. Thanks to its quasi-monoenergetic nature, the neutrons generated in the N0 beamline at RCNP are well suited to the systematic measurement of gamma-ray emission from neutron-oxygen interaction. Here, we propose a cross-section measurement of this interaction at a few neutron energies. In our previous experiment (E487), we successfully obtained a deexcitation gamma ray spectrum from the interaction of 80 MeV neutrons with oxygen, establishing the basic experimental setup for the current proposal. However, in order to better understand the neutron-oxygen interaction and to thereby constrain systematic uncertainties in future T2K measurements it is important to study the neutron-oxygen cross section over a wide range of neutron energies. To date such measurements do not exist. Therefore, we propose to further study the neutron-oxygen interaction using 30 MeV and 246 MeV neutrons using an experimental like the one in the E487 experiment.