RCNP EXPERIMENT E179

# PROPOSAL FOR EXPERIMENT AT RCNP

15 January 2002

**TITLE:**
**Three Nucleon Force Effects in $n + d$ elastic scattering at 250 MeV**

**SPOKESPERSON:**


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|---|---|
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| M.B. Greenfield | International Christian Univ. | (P) |


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| **RUNNING TIME:** | Test running time for experiment | 4 days |
| | Data runs | 11 days |
| **BEAM LINE:** | | N0 (NTOF + NPOL2) |
| | | WS course + LAS |
| **BEAM REQUIREMENTS:** | Type of particle | p |
| | Beam energy | 250 MeV |
| | Beam intensity | N0 : 50 nA (after 1/9 pulsing) |
| | | WS : 500 nA |
| | Time resolution | < 500 ps (FWHM) |

**BUDGET:**

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| Experimental expenses | 5,000,000 yen |
| Travel plan | 500,000 yen |
| Total | 5,500,000 yen |

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## SUMMARY OF THE PROPOSAL

Three-nucleon force (3NF) effect is one of the hot topics in nuclear physics. Theoretically, we can treat the three nucleon state exactly by solving Faddeev equation with modern nucleon-nucleon (NN) interaction. Therefore 3NF can be estimated by comparing precise experimental results and rigorous Faddeev calculations. Recently it has been found that the differential cross sections of elastic $p + d$ scattering at intermediate energy region can be well reproduced by incorporating 3NF in the Faddeev calculation. Furthermore, precise measurements of not only cross sections but also spin observables have been carrying out in $p + d$ scattering.

However, 3NF effects have been studied by comparing the $p + d$ experimental data with $n + d$ calculations because the inclusion of the Coulomb interaction into the calculation is very difficult. To study 3NF effects in a Coulomb-free system, we have performed the $\vec{n} + d$ elastic measurement at $E_n = 250$ MeV in the backward angular region $\theta_{cm} = 85° – 180°$.

We propose to measure the differential cross sections in $n + d$ elastic scattering at $E_n = 250$ MeV in the forward angular region. The data will be taken in an angular range where the observables are expected to be sensitive more directly to Coulomb force. These data together with the earlier one cover a full angular range and allow us to make a Coulomb free comparison to the Faddeev calculations for the first time at intermediate energy region. In addition to that, we can make a direct data-to-data comparison between this $n + d$ and existing