PROPOSAL FOR EXPERIMENT AT RCNP

22 January 2009

TITLE:
Development of Ramsey resonance for EDM measurement.

SPOKESPERSON:

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Title or Position	Associate Professor
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EXPERIMENTAL GROUP:

Name	Institution	Title or Position
S. Jeong	IPNS, KEK	Associate Professor
Y. Watanabe	IPNS, KEK	Assistant Professor
T. Adachi	Accelerator Laboratory, KEK	Associate Professor
K. Hatanaka	RCNP, Osaka University	Professor
K. Matsuta	Dep. of Physics, Osaka University	Associate Professor
R. Matsumiya	Dep. of Physics, Osaka University	D3
S. Yamasita	CEPP, The University of Tokyo	Associate Professor
J. W Martin	The University of Winnipeg	Associate Professor
L. Lee	The University of Winnipeg	Research Associate
L. Buchmann	TRIUMF	SRS
C. Davis	TRIUMF	RS

RUNNING TIME:
Running time 20 days

BEAM LINE: Ring : ES course.
BUDGET:

EDM cell	1,200 kyen
UCN valve and controller	2,600 kyen
Precision current source	1,000 kyen
Liquid helium	4,000 litter

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Development of Ramsey resonance for EDM measurement.

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SUMMARY OF THE PROPOSAL

Ultrancold neutrons (UCN) can be confined in a material bottle, because UCN energies are less than the Fermi potential of the material. Confined neutrons are used for neutron electric dipole moment (EDM), ??decay, gravity, and neutron target experiments. UCN density is the key parameter in these experiments. The precision of the current EDM measurement is limited by counting statistics, namely UCN density in the experimental bottle. For the improvement of the UCN density, we have been producing UCN in super fluid helium (He-II), which is placed in a spallation neutron source at RCNP. We obtained a UCN density of 15 UCN/cm3 in an experimental volume for neutron energies less than 90 neV at a proton beam power of 390 W, which is the world highest UCN density.

In the EDM measurement, neutron spin precession in a material bottle, which is permeated by a weak magnetic field and an electric field, is observed. The precession phase is measured as a fringe in a magnetic resonance, which is referred to as $B!H(BRamseyfringe$B!I(B. A shift of the Ramsey fringe, which is proportional to the electric field, is measured for the derivation of the EDM.

Our aim in this proposal is to observe the Ramsey fringe. We will study

1. UCN spin transport from a UCN spin polarizer to a small EDM cell, and from the EDM cell to an UCN spin analyzer,

2. T1 relaxation time of UCN in UCN guides and the EDM cell, and T2 relaxation time of UCN in the EDM cell, and

3. UCN Ramsey resonance in the weak magnetic field by use of a spherical coil. We will also improve the UCN density, which is the product of a UCN production rate and a UCN storage lifetime. The storage lifetime will increase if we place a UCN valve on the He-II bottle, and the production rate will increase if we use a higher proton current. For the improved source, we will measure

4. the UCN production rate and the storage lifetime.