RCNP EXPERIMENT E292

PROPOSAL FOR EXPERIMENT AT RCNP

July 10, 2006

TITLE: Preparing for Results from ($0\nu2\beta$) Decay: Studies of the (d,^{3}He) Reaction on Ge and Se

SPOKESPERSON:

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EXPERIMENTAL GROUP:

S. Freeman	Manchester, U.K.	Reader
S. Gros	Argonne, USA	Research Associate
K. Hatanaka	RCNP, Osaka	Professor
D. Hirata	Open University, U.K.	Visiting Researcher
B. Kay	Manchester, U.K.	Ph.D. Student
H. Matsubara	RCNP, Osaka	Student (D31)
H. Okamura	RCNP, Osaka	Professor
K. E. Rehm	Argonne, USA	Senior Physicist
J.P. Schiffer	Argonne, USA	Senior Physicist
Y. Shimizu	RCNP, Osaka	Researcher
Y. Tameshige	RCNP, Osaka	Student (D3)
A. Villari	GANIL, France	Directeur de Recherche

RUNNING TIME:

10 days (including 1 day of contingency)

BEAM LINE:

Grand Raiden

BEAM REQUIREMENTS:

Type of particle:	polarized d at 80 MeV, $^4He^+$ at < 15 MeV
Beam intensity:	$>$100 nA for d, 1-2 nA for ^{4}He
Beam polarization:	$>$0.45
Other requirements:	dispersive mode for high resolution (10 keV, if possible, for (d,^{3}He), but $<$30 keV in any case)

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SPOKESPERSON: J.P. Schiffer[a] and S. Freeman

SUMMARY OF THE PROPOSAL

Major efforts are under way to find neutrino-less double beta decay. If this decay mode is observed, the rate will provide a potentially precise, direct measure of an absolute value of the neutrino mass. Present theoretical calculations of the relevant matrix elements differ by almost two orders of magnitude. We propose precision measurements of valence nucleon occupations in one of the most likely candidates for the observation of this process by using the deuteron beams of the Osaka cyclotron. We will use the (d,3He) reaction on Ge and Se targets to measure precisely the cross sections for proton removal. Spectroscopic factors extracted from these data will reflect the proton occupation of the valence orbits, highlighting the change in this quantity between the parent and daughter nuclei in double beta decay. The use of a polarized deuteron beam, at least for a portion of the measurements, will also help resolve some ambiguities in spin assignments.