RCNP EXPERIMENT E185

PROPOSAL OF EXPERIMENT AT RCNP

15 Jan. 2002

TITLE :

Fine Structure of the Gamow-Teller and Spin-Dipole Resonance in Heavy Nuclei

SPOKESPERSONS:

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RUNNING TIME :	Beam preparation and beam tuning	2.0 days
	Data runs	7 days

BEAM LINE : WS course (dispersive beam transportation)

APPARATUS : Grand Raiden, standard VDC

BEAM REQUIREMENTS :	Type of particle	^{3}He
	Beam energy	420 MeV
	Beam intensity	10-20 nA
	Beam energy resolution	less than 150 keV
	Beam quality	single turn, halo free

BUDGET : Traget preparation 0.5 M Yen

SCHEDULE : Before the summer shutdown of 2002

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Fine Structure of the Gamow-Teller and Spin-Dipole Resonance in Heavy Nuclei

SPOKESPERSONS : von Neumann-Cosel, Peter and Fujita, Yoshitaka

SUMMARY OF THE PROPOSAL

We propose a measurement of the Gamow-Teller (GT) and spin-dipole (SDR) resonances in ^{90}Zr and ^{208}Pb with good statistics and the highest possible energy resolution ($\Delta E \leq 50$ keV FWHM) using the (^{3}He,t) reaction at 0°. The main aim is to search for characteristic scales in the fine structure of these modes utilizing recently developed new tools based on wavelet and multifractal analysis techniques. As has been demonstrated for the example of the isoscalar giant quadrupole resonance in ^{208}Pb, these scales provide unique insight into the damping of resonances through internal mixing. Furthermore, even in the regime of not fully resolved individual states, spin- and parity-separated level densities can be extracted from the data. These provide an interesting test case for recent level density calculations using the shell-model Monte Carlo technique which find a strong parity dependence not included in empirical approaches like the back-shifted Fermi gas model.

Additionally, we request some beam time for an exploratory study of a heavy deformed nucleus in the rare-earth region (e.g. ^{168}Er). Besides the above motivations, a search for the analog of the spin-flip M1 resonance observed in small-angle (p,p$'$) experiments at TRIUMF on several rare-earth nuclei is of particular interest. The measurement of the GT strength in ^{90}Zr is also of interest in relation with the quenching problem.