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Investigation of ^{11}Li excited state through proton inelastic scattering

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The ground state of ^{11}Li is known as a two neutron halo nucleus and some unconventional phenomena originated from the halo. These include the large matter radius, small two neutron separation energy, narrow component of two neutrons' momentum distribution. The excited resonant states of ^{11}Li are also expected to have some halo influenced features but because of the experimental challenges, those are not yet well understood. Especially because of its weakly bound two neutrons, we expected the appearance of multipole excitations in low excitation energy.
We aimed to investigate the excited resonant states of ^{11}Li through proton inelastic scattering. This was done using the facility with a solid H_2 target, IRIS(ISAC Charged Particle Reaction Spectroscopy Station) at TRIUMF. The window-less solid hydrogen target provides us the scope of attaining good statistics while achieving also a high excitation energy resolution ~ 400 keV in FWHM. The excitation energy spectrum of ^{11}Li was constructed by missing mass method. The results of this new experiment will be presented which show a prominent peak at around 0.80 MeV.
This peak is at a lower energy than the soft dipole resonance peaks reported in earlier studies.
DWBA calculations with a collective vibrational model excitation form factor were performed in order to understand the type of excitation. A comparison of these calculations with the angular distribution of the peak indicates an l=0 transition. This suggests the possibility of a new soft monopole excitation.

Primary author: Mr TANAKA, Junki (RCNP)

Co-authors: VARELA, A.Diazvar (University of Guelph); SANETULLAEV, Alisher (Saint Mary's University); Dr BURBADGE, Christina (University of Guelph); HACKMAN, Greg (TRIUMF); Dr BIDAMAN, Harris (University of Guelph); TANIHATA, Isao (RCNP,Beihang University); EVEN, J (TRIUMF); SMITH, J (TRIUMF); Dr ALCORTA, Martin (TRIUMF); KEEFE, Matthew (Saint Mary's University); WORKMAN, Orry (Saint Mary's University); Prof. KANUNGO, Rituparna (Saint Mary's University); KAUR, Satbir (Saint Mary's University); ISHIMOTO, Shigeru (KEK); CRUZ, Steffen (TRIUMF)

Presenter: Mr TANAKA, Junki (RCNP)

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