



Contribution ID: 179

Type: **Invited Abstract**

Proton inelastic scattering reveals deformation in ^8He

Monday, 13 June 2022 09:40 (30 minutes)

The nucleus ^8He is the most neutron-rich nucleus known. Its structure, consisting of a ^4He core surrounded by four neutrons makes it an ideal case to study phenomena in highly neutron-proton asymmetric systems and neutron correlations at the nuclear surface.

An experiment studying proton inelastic scattering of ^8He has been carried out at the IRIS setup at ISAC-II at TRIUMF. It utilized the novel IRIS solid H_2 target in combination with a low pressure ionization chamber for the identification of incoming beam particles and two ΔE - E telescopes to measure the reaction products.

The measurement shows a resonance at 3.54(6) MeV with a width of 0.89(11) MeV. The energy of the state is in good agreement with both coupled cluster and no-core shell model with continuum calculations. The latter describes the measured resonance width as well.

The differential cross section of the resonance has been analyzed with phenomenological collective excitation form factor and microscopic coupled reaction channels framework. Both analyses reveal a large deformation parameter $\beta_2=0.40(3)$, consistent with no-core shell model predictions of a large neutron deformation.

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Session Classification: NS2022 Plenary

Track Classification: Oral Presentations