Nuclear Structure as a necessary input to determining the neutrino mass via neutrinoless double beta decay ($0\nu\beta\beta$)

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Neutrinoless double-beta ($0\nu\beta\beta$) decay is one of the most promising experimental phenomena capable of probing the fundamental properties of the neutrino. The observation of this hypothetical weak-interaction process would signal a violation of total lepton number conservation and establish the Majorana nature of the neutrino. It will also provide experimental access to the absolute neutrino mass scale, provided that the nuclear matrix elements (NME) mediating the decay are reliably known. However, results of current nuclear structure calculations of the NMEs are found to differ by up to a factor of 3, depending on the methodology. Experimental input from a nuclear structure perspective to constrain these calculations is, thus, essential as this would allow models to be selected or developed based on reproducible benchmarking criteria. In this talk, I will present results from a high-precision Coulomb excitation measurement aimed at providing experimental data as input to theoretical models used in calculating $0\nu\beta\beta$ NME. The talk will focus primarily on the electromagnetic properties of low-lying states in 76Ge, a nucleus with one of the highest $0\nu\beta\beta$ discovery potential. The experiment was performed at the ATLAS facility at the Argonne National Laboratory using the advanced gamma-ray tracking array, GRETINA, and the charged-particle detector, CHICO2. The influence of the axial asymmetry parameter on the shape of this nucleus along with the results of multiconfiguration mixing calculations carried out within the framework of the triaxial rotor model will be highlighted. Most importantly, new experimental evidence characterizing the precise nature of triaxial deformation in 76Ge will be presented. The results will also be compared with state-of-the-art shell model calculations, with emphasis on demonstrating the importance of nuclear deformation in determining the nuclear decay matrix elements relevant to neutrinoless double-beta decay ($0\nu\beta\beta$).

Tuesday, March 21st, 2023

4:00 pm

Lindley Hall room 321