IMPROVED DSAM MEASUREMENTS AS A TEST OF AB-INITIO CALCULATIONS: THE CASE OF ^{10}BE

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INTRODUCTION

The development of ab-initio methods to calculate the properties of light nuclei addresses one of the most fundamental goals of nuclear structure, to understand nuclei starting from the basic interactions among individual nucleons.

METHOD

Using realistic two nucleon and three nucleon potentials combined with Green's Function Monte Carlo techniques, ab-initio calculations can now predict binding energies and wavefunctions of nuclear states through A = 12. These calculations have emphasized the significance of 3-body interactions. In the A = 10 systems, the inclusion of 3-body forces inverts the sequence of some states, which has been linked to the important contribution of the 3-body interaction to the overall spin-orbit force. To challenge these latest calculations, a new generation of Doppler Shift Attenuation (DSAM) measurements is required to precisely (<5%) determine the matrix elements between excited states.

RESULTS

Lifetimes of excited levels in ^{10}Be, produced in a heavy-ion fusion evaporation reaction, were determined using high velocity DSAM measurements. The recoiling ^{10}Be were detected at zero degrees to the beam direction using the Argonne Fragment Mass Analyzer and gamma rays measured with Gammasphere. This combination allowed for the collection of very clean gamma-ray spectra, precise determination of the reaction kinematics, and the elimination of cascade feeding. Preliminary results of the experiment will be presented and discussed in terms of recent ab-initio calculations.

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