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Determination of matrix elements in 62Ni to test surface vibrations in nuclei

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The multiphonon model of surface vibrations, a foundational pillar that nuclear physics is built upon is being questioned using detailed spectroscopy. The breakdown of vibrational selection rules has been confirmed in the paradigmatic Cd isotopes. Such selection rules involve particular relations for reduced transition probabilities e.g.$B(E2, 0_2^+ \rightarrow 2_1^+) = 2 \times B(E2, 2_1^+ \rightarrow 0_1^+)$ or a null spectroscopic quadrupole moment for the first 2+ state, are explored in this work for the vibrational candidate ^{62}Ni. Beams of ^{62}Ni at an energy of 237.5 MeV and an intensity of ˜1 pnA were accelerated for the first time to determine matrix elements directly via a Coulomb-excitation reaction, and bombarded onto a ^{194}Pt enriched target (96\%). The soccerball frame at IThemba LABS part of the GAMKA project and an upstream double-sided silicon detector with 24 rings and 32 sectors were used to measure gamma-particle coincidences. Doppler-shift methodology was used to calculate energy shifted gamma rays. The GOSIA Coulomb-excitation code was used to extract the matrix elements. Results will be presented at SAIP2022, which may shed light onto the existence of surface vibrations in nuclei.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

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