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Study of proton elastic scattering on carbon-12 using MCAS

Proton elastic scattering on ^{12}C is a technique for obtaining detailed information about resonance states and energy levels of ^{13}N . The interaction between protons and carbon nuclei is also important for ion-beam analysis (IBA) used for light element depth profiling in solids.

Discrepancies have emerged in cross-section data at laboratory scattering angles of 150° and 170° between older and recent datasets [1-6] especially around the $E_p = 1735 \text{ keV}$ ($\frac{5}{2}^+$) resonance region. Evaluated data from [7], which is based on R-matrix combined with a potential model and is considered the most dependable by the IBA community, supports the older data. However, as this evaluation relies heavily on the quality and availability of experimental data, it has limitations, particularly in the interpretation of resonances, and inconsistencies with new data that keeps emerging.

In order to provide an external, data-independent analysis, we have undertaken a study employing the Multichannel Algebraic Scattering (MCAS) method [8]. This approach uses scattering potentials derived from structural models to predict resonance positions independent of amplitude evaluations or data fitting and to analyze the sensitivity of resonance magnitudes to structure model considerations.

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Primary author: BHATTACHARYYA, Deeparna (University of New South Wales, Australia)

Co-authors: AMOS, K. (University of Melbourne, Australia); CANTON, L. (Istituto Nazionale di Fisica Nucleare, Sezione di Padova, Italia); FRASER, P. R. (University of New South Wales); MOSS, R. G. (University of Melbourne, Australia); KARATAGLIDIS, S. (University of Johannesburg, South Africa)

Presenter: BHATTACHARYYA, Deeparna (University of New South Wales, Australia)

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