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Constraining Optical Model Potentials for p-process Nucleosynthesis through Elastic Scattering on 144Sm and 148Sm

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Nucleosynthesis is the branch of physics that studies the creation sites and mechanisms of the elements present in our universe. The synthesis of the proton-rich stable isotopes heavier than iron, known as the p-nuclei, remains one of the open questions in nuclear astrophysics. Their production in high-temperature stellar environments critically depends on reaction rates involving α-induced channels, which are themselves governed by the α-nucleus optical model potential (AOMP). However, significant discrepancies persist between existing global AOMPs, leading to large uncertainties in astrophysical network calculations.

In this talk, I will introduce the experiment carried out by our team, which is the α-elastic scattering on ^{144}Sm and ^{148}Sm at incident energies around 20 MeV, measured at the ALTO facility (Orsay). The comparison of these two isotopes is central to the study: ^{144}Sm is semi-magic (N = 82), and most modern AOMPs are fitted or benchmarked using elastic data from such nuclei, while ^{148}Sm is not magic. This structural contrast provides a stringent test of the sensitivity and transferability of current AOMPs when applied beyond the semi-magic region. Furthermore, the data allow us to constrain the cross-section ratio between the first excited state and the ground state in ^{148}Sm, providing additional information on coupling effects and reaction channel strengths.

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