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Probing the neutron skin and nuclear symmetry energy with relativistic isobar collisions

Neutron structure and skin thickness in nuclei have been traditionally measured by low-energy scatterings where the nuclei are only gently disturbed. Their precision has been limited by theoretical uncertainties in modeling the nuclear force. Here, we propose an unconventional approach to probe the neutron skin by smashing isobar nuclei completely apart at relativistic energies. We demonstrate that the small difference in several observables between isobar collisions, together with state-of-the-art calculations of nuclear structure, can provide an exquisite sensitivity to the poorly constrained neutron density distributions and skin thickness, which can in turn put stringent constraints on the nuclear symmetry energy.

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