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Probing the neutron skin with ultrarelativistic isobaric 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 have 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 to compare their produced hadron multiplicities[1,2] and net charge multiplicities[3]. We demonstrate that the small difference in hadron multiplicities and net charge multiplicities 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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Primary authors: WANG, Fuqiang (Huzhou University); Dr XU, Haojie (Huzhou University)

Presenter: Dr XU, Haojie (Huzhou University)