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Stiff symmetry energy from isovector aura in charge-exchange reactions

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On account of symmetry energy dropping with density, nuclear isovector density extends farther out than the isoscalar density, leading to an isovector aura surrounding a nucleus. The faster the drop of the symmetry energy and energy of neutron matter with density, the thicker the aura. The width and sharpness of the aura can be assessed by simultaneously analyzing elastic scattering and quasielastic charge-exchange data off the same target, with the two, respectively, testing primarily isoscalar and isovector densities. In the past (P. Danielewicz et al., Nucl. Phys. 958, 147 (2017)) we analyzed unpolarized nucleon elastic and quasielastic cross sections on 48Ca, 90Zr, 120Ca and 208Pb. We now augment the analyzed set with two more targets, 92Zr and 94Zr, and expand the data to include vector analyzing powers. The results consistently point to large widths, ~1fm, of the isovector aura, now for 6 nuclei. Such an aura implies stiff symmetry energy, with a slope parameter L>70MeV, and stiff energy of neutron matter. The neutron skins may be viewed as nucleus-dependent reflections of the aura.

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