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Neutron skins and neutron stars in the multi-messenger era[1]

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The historical first detection of a binary neutron star merger by the LIGO-Virgo collaboration is providing fundamental new insights into the astrophysical site for the r-process and on the nature of dense matter. Limits on the tidal polarizability inferred from the gravitational wave signal translate into constraints on the neutron-star radius. Based on these constraints, models that predict a stiff symmetry energy, and thus large stellar radii, can be ruled out. Given the sensitivity of the neutron-skin thickness of 208Pb to the symmetry energy, we infer an upper limit on the neutron skin significantly lower than the one reported by the PREX collaboration. However, if the upcoming PREX-II experiment confirms that the neutron-skin thickness of 208Pb is large, this may be evidence in favor of a softening of the symmetry energy at high densities, likely indicative of a phase transition in the interior of neutron stars.

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