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Status, problems, and perspectives on symmetry energy

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The status of current constraints on the symmetry energy and generally nuclear equation of state (EoS) from laboratory measurements and astrophysical observations is discussed. Determination of the symmetry energy from data requires knowledge of the EoS of symmetric matter, and the heavy-ion collisions (HIC) are the only means of constraining EoS experimentally at supranormal densities. Improving the constraints requires, on the one hand, a reduction in theoretical inference uncertainties and, on the other, the development of more constraining experimental observables, e.g., by employing Machine-Learning techniques in data analysis. Improving upon direct extraction of the symmetry energy from HIC requires simultaneous constraining of sensitivity to isospin of different transport ingredients, including mean-fields and collision and new particle production rates. Overlap of interests in EoS from the neutron-star (NS) and HIC sides creates novel opportunities for HIC inferences as there is interest from the NS side in the momentum-dependence of interactions and finite-temperature EoS.

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