Equation of state effects in core-collapse supernovae

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We investigate the impact of different properties of the nuclear equation of state in core-collapse supernovae, with a focus on the proto-neutron-star contraction and its impact on the shock evolution. To this end, we introduce a range of equations of state that vary the nucleon effective mass, incompressibility, symmetry energy, and nuclear saturation point. This allows us to point to the different effects in changing these properties from the Lattimer and Swesty to the Shen *et al.* equations of state, the two most commonly used equations of state in simulations. In particular, we trace the contraction behavior to the effective mass, which determines the thermal nucleonic contributions to the equation of state. Larger effective masses lead to lower pressures at nuclear densities and a lower thermal index. This results in a more rapid contraction of the proto-neutron star and consequently higher neutrino energies, which aids the shock evolution to a faster explosion.

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