Contribution ID: **6** Type: **Oral Contribution**

Core-collapse supernovae and equation of state effects*

Wednesday, 14 August 2019 11:30 (20 minutes)

Core-collapse supernovae (CCSN) are cosmic laboratories for physics at the extremes and numerical simulations are essential to help us understand the underlying mechanisms in these events. A key ingredient in simulations is the equation of state (EOS), which determines the contraction behavior of the proto-neutron star (PNS) and thus impacts neutrino energies and explosion dynamics. However, the EOS for hot and dense matter is still not fully understood and CCSN simulations rely on EOS models that differ in their underlying theory and nuclear matter properties.

We present the first systematic study on the impact of different nuclear matter properties of the EOS in CCSN simulations. This allows us to examine possible reasons for differences in commonly used EOS in simulations. We find that the contraction behavior of the PNS is mainly governed by the effective mass, which impacts the shock propagation.

*Supported by the Deutsche Forschungsgemeinschaft through SFB 1245 (Projektnummer 279384907) and the European Research Council Grant No. 677912 EUROPIUM.

Keywords

Core-Collapse Supernovae

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Session Classification: Equation of State