

The Effects of Neutrino Oscillations on Core-Collapse Supernova Explosions

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At the present time even the most sophisticated, multi-dimensional simulations of core-collapse supernovae do not (self-consistently) include neutrino flavor transformation. This physics is missing despite the importance of neutrinos in the core-collapse explosion paradigm. Because of this dependence, any flavor transformation that occurs in the region between the proto-neutron star and the shock could result in major effects upon the dynamics of the explosion.

We present the first hydrodynamic core-collapse supernova simulation which simultaneously includes flavor transformation of the free-streaming neutrinos in the neutrino transport. These oscillation calculations are dynamically updated and evolve self-consistently alongside the hydrodynamics. Using a $M = 15 M_{\odot}$ progenitor, we find that while the oscillations can have an effect on the hydrodynamics, flavor transformation alone does not lead to a successful explosion of this progenitor.

Keywords

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