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Moment neutrino flavor transformation: application to the fast-flavor instability in neutron star mergers

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The accretion disk that forms following a neutron star merger ejects a significant amount of matter that contributes to the appearance of the kilonova transient and the chemical evolution of the Universe. Irradiation of this ejecta by electron neutrinos and antineutrinos changes the composition of this outflow, but neutrinos are also known to change flavor on timescales of nanoseconds (so-called “fast-flavor oscillations”), the consequences of which are not well understood. Based on the neutrino radiation field drawn from a three dimensional neutron star merger simulation, we perform local (centimeter-scale) three-dimensional two-flavor simulations of the fast flavor instability using an extension of the truncated moment formalism to neutrino quantum kinetics. We discuss the validity and advantages of this method by comparing the results against two- and three-flavor particle-in-cell simulations, as we get generally good agreement in the instability growth rate and the final flavor abundances.

Submitted on behalf of a Collaboration?

No

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