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Toward Simulating Flavor Instability in Neutron Star Mergers

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While neutrino flavor transformation in low-density environments is the target of many experimental and observational campaigns, the rich phenomenology of neutrino flavor transformation in neutrino-dense environments like core-collapse supernovae and neutron star mergers is presently the object of intense theoretical efforts. These phenomena have the potential to alter the course of explosion, mass ejection, and nucleosynthesis, but the small length and time scales seem to make direct simulation impossible. I will present our work to reliably account for flavor transformation effects on multiple fronts, including particle-in-cell methods, moment methods, and machine-learning sub-grid models, and discuss the potential implications for future multi-messenger observations.

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