

W35a Quasi-Static Analysis of Collective Neutrino Flavor Conversions in Core-Collapse Supernovae

Jiabao Liu, Waseda University

The interplay between collective neutrino flavor instabilities and core-collapse supernova (CCSN) dynamics is of growing interest due to its potential influence on explosion mechanisms. However, directly solving neutrino flavor conversions within CCSN models remains computationally infeasible because of the short temporal and spatial scales involved. This study introduces the quasi-static analysis approach, which self-consistently integrates the effects of flavor conversions into CCSN simulations. Unlike previous approximations that assume instantaneous relaxation to a flavor conversion quasi-steady state, this method accounts for deviations arising from the slow evolution of the neutrino background. By modeling the secular evolution of the quasi-static state, this framework predicts time-dependent flavor conversion outcomes on astrophysically relevant, slowly varying neutrino radiation fields. These advancements offer a robust method for capturing the dynamical impacts of flavor conversions on CCSNe, addressing a critical gap in current simulation capabilities.