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CCSN Simulation with Spectral Two-Moment Neutrino Transport Using FLASH[1] RAN CHU, University of Tennessee, AUSTIN HARRIS, Oak Ridge National Laboratory, EIRIK ENDEVE, BRONSON MESSER, University of Tennessee, Oak Ridge National Laboratory, ANTHONY MEZZACAPPA, University of Tennessee — We are developing the toolkit for high-order neutrino-radiation hydrodynamics (thornado) to model neutrino transport in core-collapse supernova (CCSN) explosion simulations. thornado, which implements spectral two-moment neutrino transport using the discontinuous Galerkin method and implicit-explicit time stepping[2], as well as WeakLib[3], a library providing tabulated microphysics, has been coupled with FLASH[4] as an external library. With this enhanced FLASH code, we aim to simulate CCSN explosions in multiple spatial dimensions. Here we present (1) a detailed comparison between Boltztran[5] and thornado in the context of a fixed, spherically symmetric, post-bounce profile from a simulation that used the LS220 equation of state (EoS) and "Bruenn 85" neutrino opacities, and (2) the spherically symmetric gravitational collapse of a 15 solar mass progenitor using the SFHo EoS, Bruenn 85 opacities, FLASH's Newtonian hydrodynamics with self-gravity, and thornado's neutrino transport.

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[2] Chu et al. 2019, JCP, 389, 62; Laiu et al. 2020, J. Phys.: Conf. Ser. 1623, 012013; Laiu et al. 2020, ApJS (submitted)

[3] github.com/starkiller-astro/weaklib

[4] Fryxell et al. 2000, ApJS, 131, 273

[5] Mezzacappa and Bruenn 1993, ApJ, 405, 669

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