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Toward Connecting Core-Collapse Supernova Explosions with Observations of their Supernova Remnants TIMOTHY HANDY, TOMASZ PLEWA, Florida State University, ANDRZEJ ODRZYWOLEK, Jagiellonian University — We study the process of collapse of a massive star and the following explosion process until the formation of a young supernova remnant in a single simulation. These new models are critically evaluated against a database of core-collapse supernovae (ccSNe) explosion models obtained with a standard supernova code. We develop a multiphysics hydrocode capable of accounting for physics from before collapse occurs until the supernova remnant phase. This enables ccSNe studies with a single code without the need of remapping or transferring data between multiple codes. The code uses a new algorithm to account for the effects of neutrino-matter interaction in the collapsing stellar core. The algorithm uses ray-casting in three dimensions and enables performing collapse and explosion simulations on AMR meshes, including non-radial discretizations. Heating due to radioactive decay, and magnetization of the ejecta are included in the model. The asymmetry of the explosion continues to play a role well beyond the shock breakout phase. In particular, the lateral momentum deposited in the process of shock revival helps shape the supernova ejecta. Another important contributing factor shaping the ejecta is due to radioactive decay of nucleosynthetic products of the explosion.

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