Parallelization and Vectorization of nuDust

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Abstract

Using a suite of 1D core-collapse supernovae (CCSNe) models of varying progenitor masses and explosion energies, we model dust grain formation in the late time ejecta-phase. With this suite of dust grain formation models, we hope to answer these important questions: 1) Does dust yield depend on the explosion energy and progenitor of the CCSN? 2) Can we use observations of dust as a tracer in young supernova remnants (ySNRs) to obtain information on the explosion and the progenitor star? In an effort to accelerated this research, we extended the parallelism and vectorization capabilities of the open-source code *nuDust*. Exploiting the inherent data parallelism of Lagrangian hydrodynamics, we scaled *nuDust* from single-process execution to large-scale parallel execution on LANL HPC machines. We report on our methods for parallelism and results, and show promising initial work using on vectorization and off-loading using *numba*, a library for the just-in-time compilation of NumPy routines.