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Modeling turbulence-aided core-collapse supernova explosions in spherical symmetry

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We present a new method for artificially driving core-collapse supernova explosions in 1D simulations. Turbulence is important for understanding the CCSN explosion mechanism, since turbulence may add a >20% correction to the total pressure behind the shock and thus aid in the explosion. We have implemented mixing length theory (MLT) and included a model of the turbulent pressure in the FLASH supernova code for spherically symmetric simulations. Including MLT and corrections for the turbulent pressure may result in successful explosions in spherical symmetry without altering the neutrino luminosities or interactions, as is commonly done to produce explosions in spherical symmetry. This better replicates the physical explosion mechanism and more reliably produces the thermodynamics and composition, which is vital for accurately predicting the nucleosynthesis that occurs in the supernova environment.

Primary author: Dr WARREN, MacKenzie (Michigan State University)

Presenter: Prof. COUCH, Sean (Michigan State University)

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