Computational Astrophysics at the Petascale: Towards Three-Dimensional Supernova Modeling

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The multi-scale and multi-physics character of many problems in astrophysics make them ideal candidates for investigation through large-scale simulations on modern supercomputers. Among the most computationally demanding of these problems is the explosion mechanism and phenomenology of core-collapse supernovae. The panoply of physical inputs, the time and length scales involved, and the necessity of performing simulations in three spatial dimensions makes supernova modeling among the most challenging subfields of computational science. I will review recent multi-dimensional simulations of these events and describe plans to perform petascale supernova simulations in three spatial dimensions incorporating all the requisite physical inputs known to be important today.