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New Physical and Numerical Insights into the Core-Collapse Supernova Mechanism

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Core-collapse supernovae have challenged theorists and computational science for half a century. Such explosions are the source of many of the heavy elements in the Universe and the birthplace of neutron stars and stellar-mass black holes. However, determining the mechanism of explosion remains the key goal of theory. Though the synergistic operation of turbulence and neutrino heating seems implicated, and multi-dimensional simulations with some physical fidelity that have provided insight, we have yet to reproduce the phenomenon theoretically. In this talk, I will review the goals of supernova theory, the state of the field, and new numerical insights into the contending explosion models.