Abstract Submitted for the APR09 Meeting of The American Physical Society

The Formation of Black Holes in Failing Core-Collapse Supernovae EVAN O'CONNOR, CHRISTIAN D. OTT, E. STERL PHINNEY, TAPIR, Caltech — We present new simulations of black hole formation in dying massive stars using 1D GR hydrodynamics, multiple finite-temperature nuclear equations of state and parameterized neutrino heating and cooling. Via a sweep through the progenitor mass range from 10 to 100 solar masses, metallicity from zero to solar and various neutrino luminosities/heating efficiencies, we establish for the first time in a systematic fashion the conditions necessary for black hole formation to occur in the limiting case of spherically-symmetric postbounce core-collapse dynamics. Since multi-D effects such as rotation or convective overturn can act only to prolong the time to black hole formation or prevent it altogether, our new results also constrain collapsar/GRB progenitor stellar structure.

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Date submitted: 09 Jan 2009

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