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Multidimensional Simulations of Thermonuclear Supernovae from The First Stars[1] KE-JUNG CHEN, ALEXANDER HEGER, School of Physics and Astronomy, University of Minnesota, ANN ALMGREN, Computational Research Division, Lawrence Berkeley National Lab — Current models of the formation of the first stars in the universe suggest that these stars were very massive, having a typical mass scale of hundreds of solar masses. Such stars would explode as pair instability supernovae (PSNe). These supernovae hold the key to understanding the formation of the first heavy elements and the first galaxy formation in the universe. The current theoretical models for PSNe are all based on one-dimensional calculations; until now, multidimensional simulations have been scarce. We present the results from multidimensional numerical studies of PSNe with a new radiation-hydrodynamics code, CASTRO and with realistic nuclear reaction networks. We simulate the fluid instabilities that occur in multiple spatial dimensions and discuss how the resulting mixing affects the explosion, mixing, and nucleosynthesis of these supernovae.

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