

APR08-2008-000473

Abstract for an Invited Paper
for the APR08 Meeting of
the American Physical Society

Modeling Type Ia Supernova Explosions

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Type Ia Supernovae are one class of bright stellar explosions that are distinguished by a lack of hydrogen in the observed spectra. The most widely accepted scenario is a thermonuclear runaway occurring in a C/O white dwarf that has gained mass from a companion star. The details of the explosion mechanism are incompletely understood, and at present there are competing models that differ in the details of the initial conditions and the nature of the thermonuclear burning. I will present an overview of proposed mechanisms for the explosion and describe the requisite physics for each. Many scenarios invoke a deflagration born near the center of the white dwarf, and the subsequent evolution of the fireball sensitively depends on the relative size of the ignition point and its location. I will describe the flame and ash nuclear energetics and demonstrate that for the case of rising bubbles, featured in some explosion scenarios, the bubble evolution depends sensitively on the nuclear physics included in the models.