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A Semi-Analytic Model of a Buoyant Flame Bubble Propagation During the Deflagration Phase of a Type Ia Supernova KEVIN JUMPER, ROBERT FISHER, University of Massachusetts Dartmouth — Type Ia supernovae are astronomical events in which a white dwarf, the cold remnant of a star that has exhausted its hydrogen fuel, detonates and briefly produces an explosion brighter than most galaxies. Many researchers think that they could occur as the white dwarf approaches a critical mass of 1.4 solar masses by accreting matter from a companion main sequence star, a scenario that is referred to as the single-degenerate channel. Assuming such a progenitor, we construct a semi-analytic model of the propagation of a flame bubble ignited at a single off-center point within the white dwarf. The bubble then rises under the influences of buoyancy and drag, burning the surrounding fuel material in a process called deflagration. We contrast the behavior of the deflagration phase in the presence of a physically high Reynolds number regime with the low Reynolds number regimes inherent to three-dimensional simulations, which are a consequence of numerical viscosity. Our work may help validate three-dimensional deflagration results over a range of initial conditions.

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