

Impact of Resolution on Double-Detonation Models for Type Ia Supernovae

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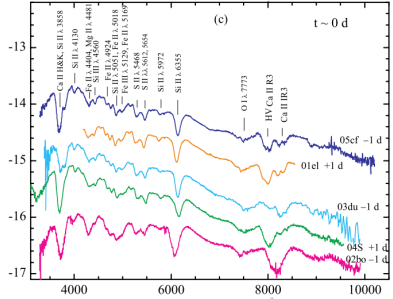
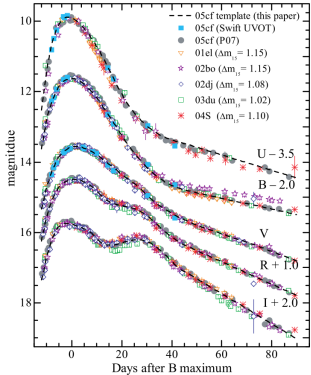
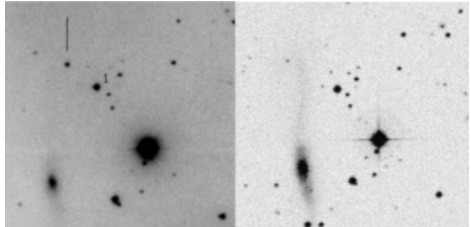
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2022ApJ...937....2R



SN Ia (2005cf)(2009ApJ...697..380W)

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Name	Companion	Material
Chandrasekhar (M_{Ch})	Deg/Non-Deg	H or He
near-Chandra (nearCh)	Deg	He
Double WD (DWD)	Deg	He, C, O, Ne



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Property Ranges	
White dwarf size/mass	$\sim 5000\text{km}, \sim 1.0M_{\odot}$
Envelope size/mass	$\sim 2000\text{km}, \sim 0.1M_{\odot}$
Temperatures	10^6 to 10^{10} K
Densities	10^{-2} to 10^6 $\text{g} \cdot \text{cm}^{-3}$
Pressures	10^{17} to 10^{27} $\text{dyne} \cdot \text{cm}^{-2}$
Detonation timescale	~ 1.0 s
Detonation speeds	10^7 to 10^9 $\text{cm} \cdot \text{s}^{-1}$
Rayleigh Number	$>10^{11}$



Hydro PPM solver for the compressible Euler equations.

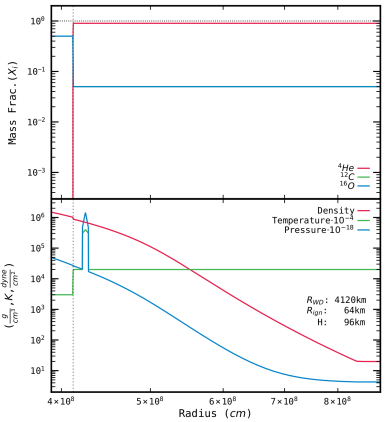
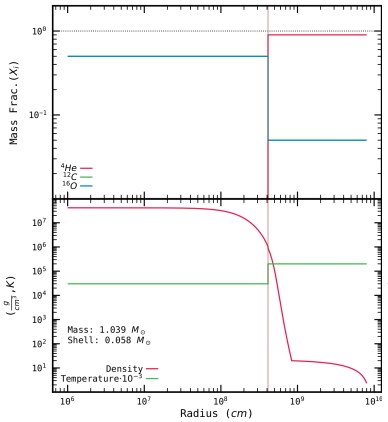
EoS updates hydrodynamic or thermodynamic ones as required by **Hydro** and **Burn**, respectively (Helmholtz free-energy tables).

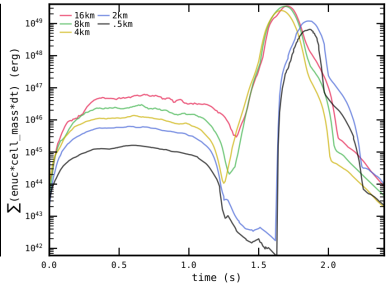
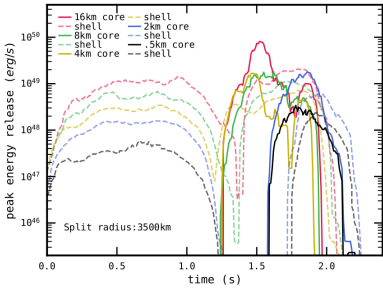
Grid uses an adaptive mesh refinement (AMR) criteria to increase the resolution of the simulation where needed (2000ApJS..131..273F)

Burn calculates burning energy release for a given network of species. 13 alpha isotope network used. (1999ApJS..124..241T)

Gravity Poisson equation solver for the simulation density field via a multipole expansion, yielding an external field for the **Hydro** module. (8 moments)







Overall Dynamics

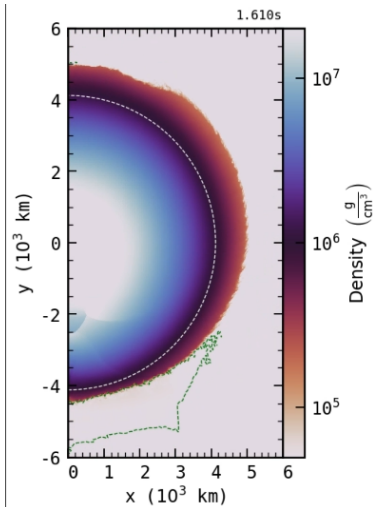
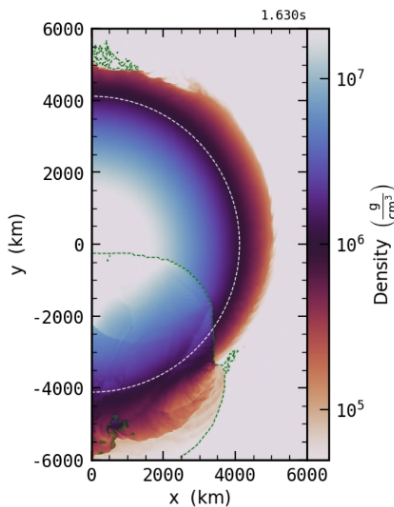
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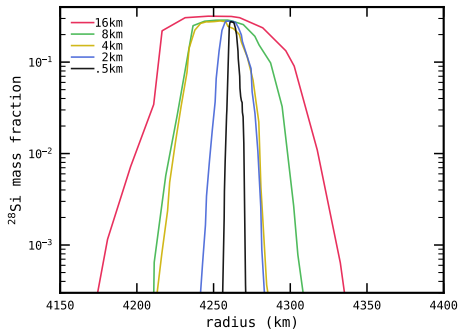


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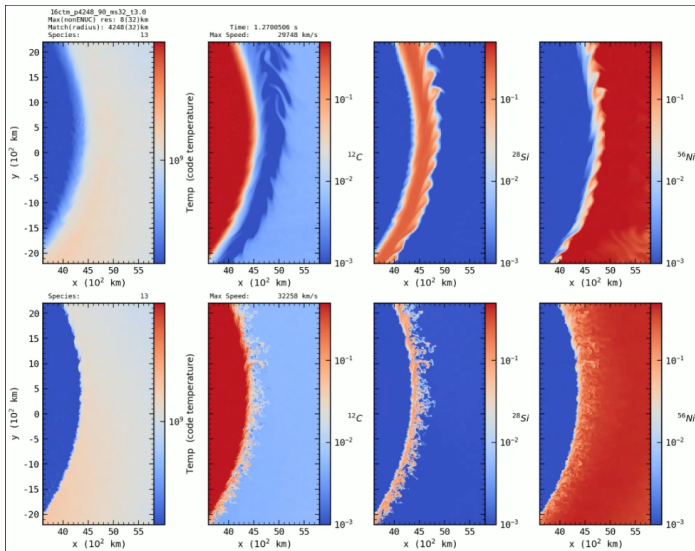


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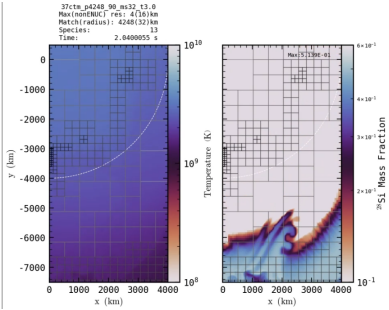
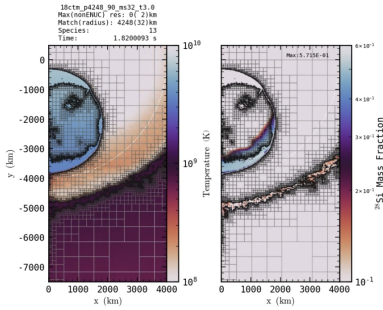


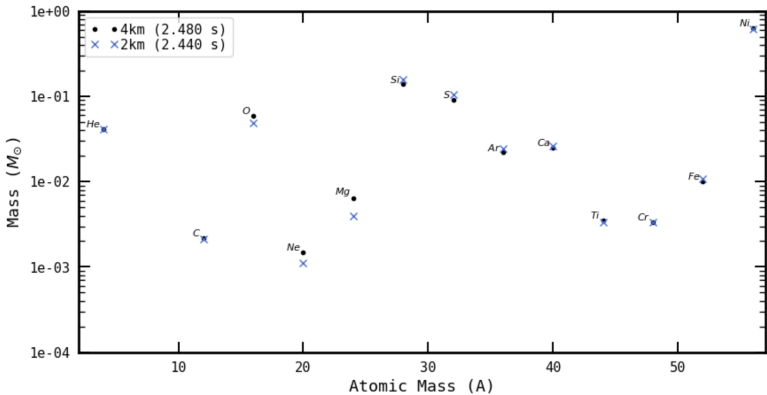
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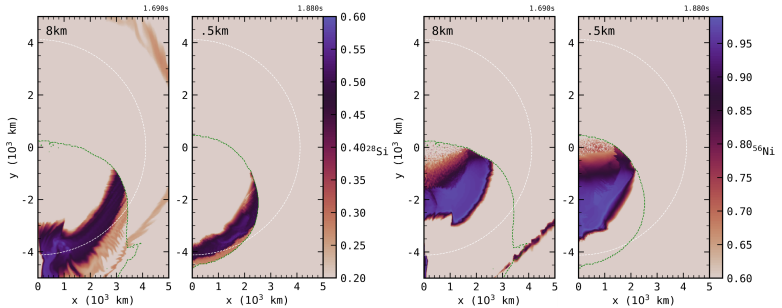


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Yield Distribution

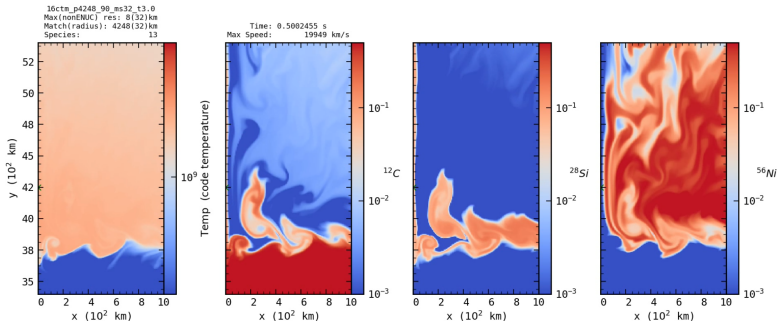
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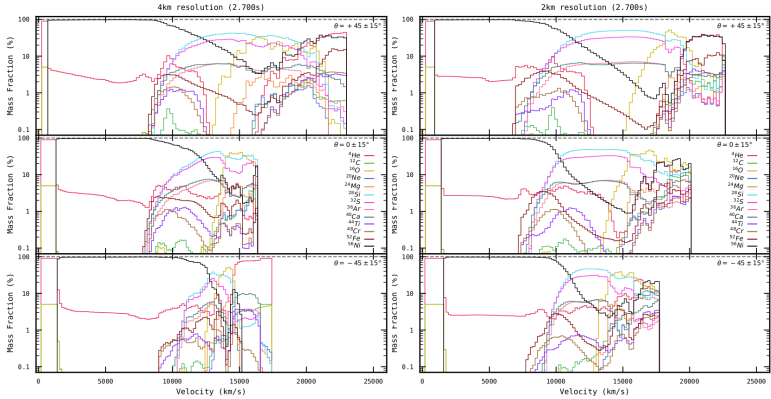
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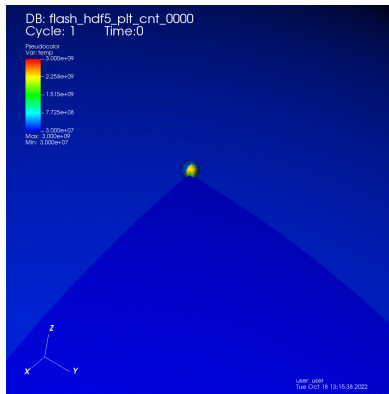
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1D says 1km (Katz 2019ApJ...874..169K)

SPH says maybe? (Gronow 2021A&A...649A.155G: 30km
resolution with mixed results)



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Thank You!



IRL(h) : 100.01, Subs: 37, Node h: 7788.33

