Turbulently-Driven Detonation Initiation in Electron-Degenerate Matter with Helium

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AAS 237

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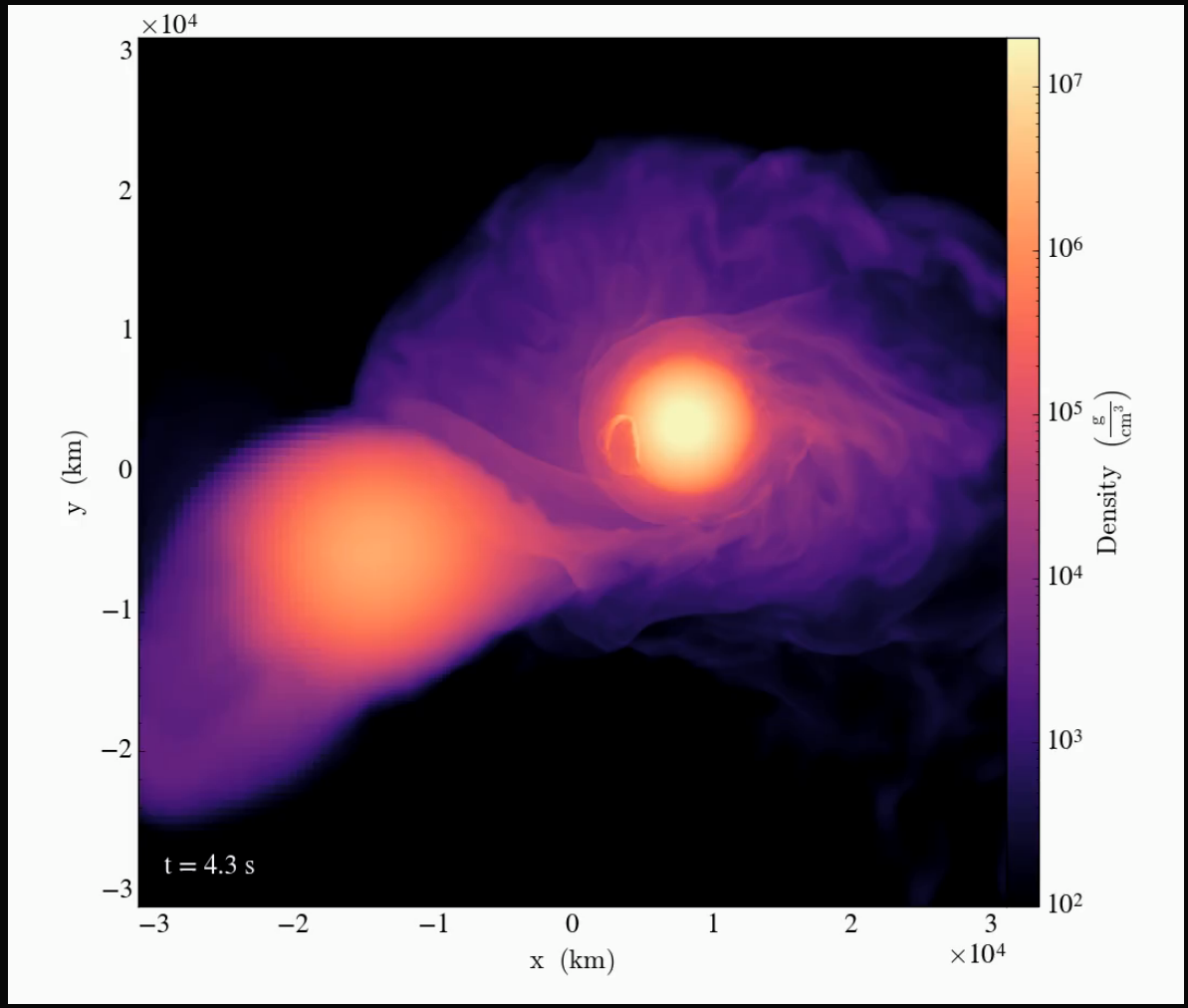
Motivation: D6



Vishal Tiwari (2019)

Carbon Detonation

- Turbulently-Driven Detonation Mechanism of Carbon
- Fisher RT, Mozumdar P, Casabona G. 2019. Carbon Detonation Initiation in Turbulent Electron-Degenerate Matter. The Astrophysical Journal.

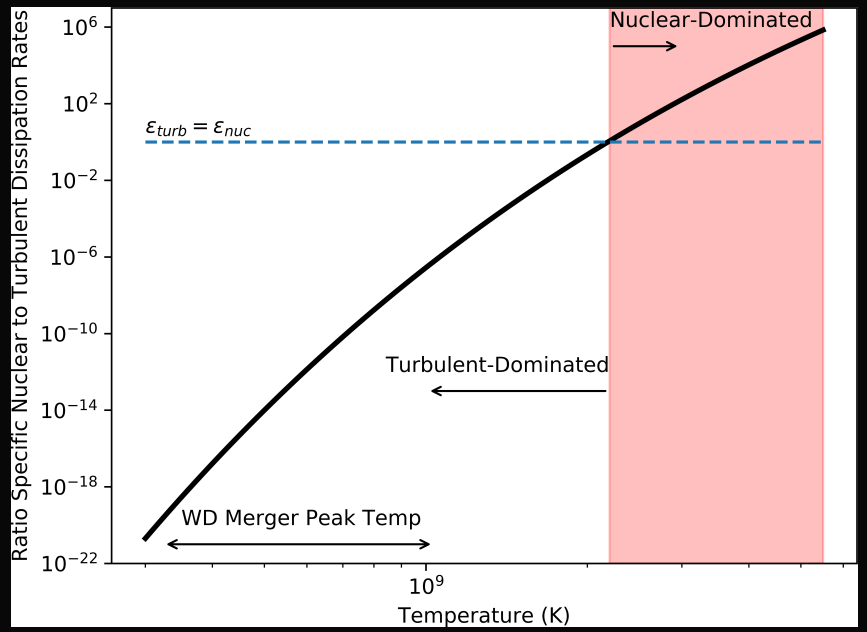


Figure: Analytic Curve for Carbon Detonation

Method

- 3D Hydro Models
- Uniform Grid
- Driving force for turbulence on box scale

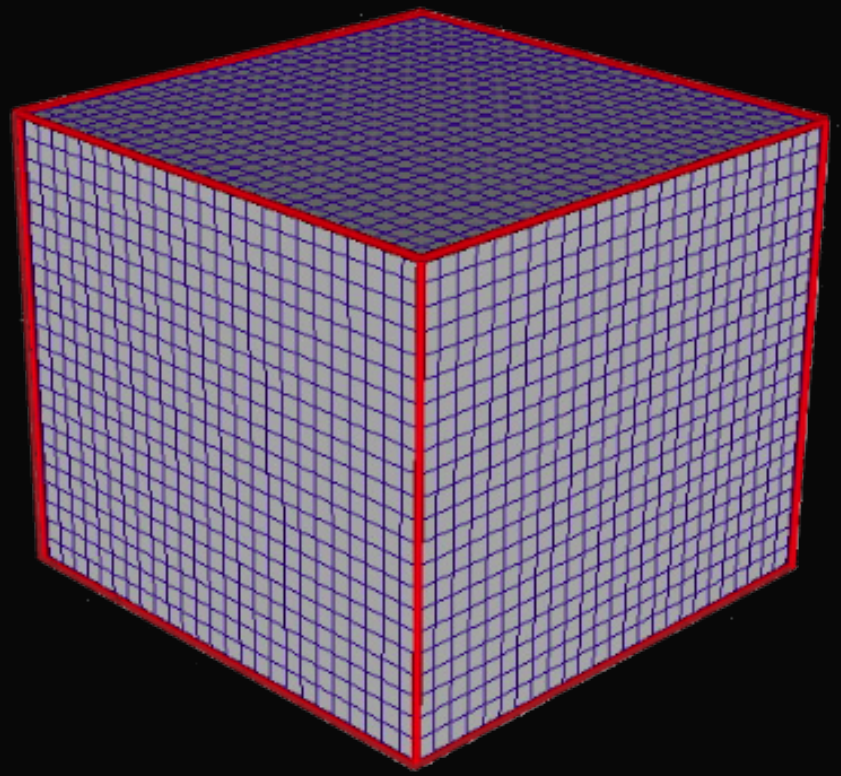
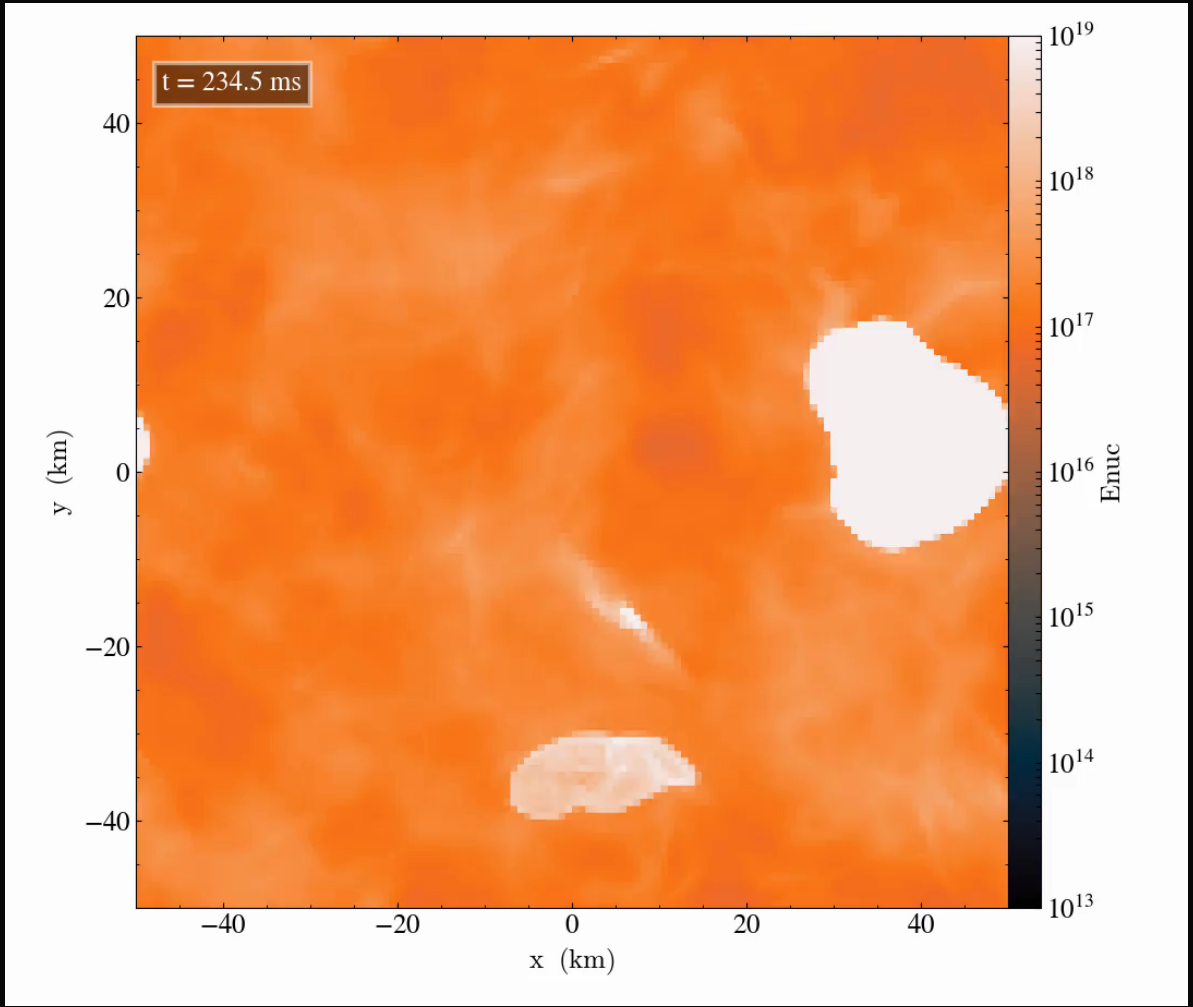


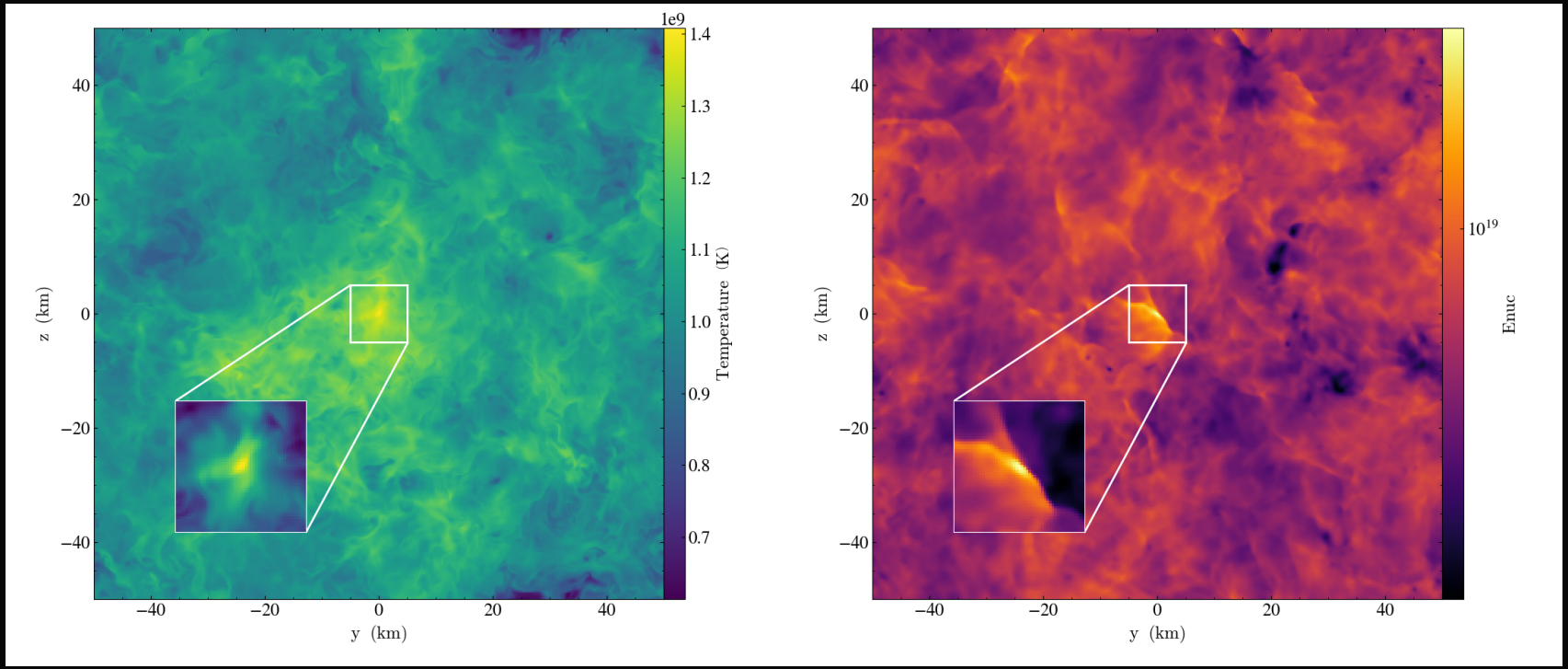
Figure: 100 km box

Detonation of Pure He Run With C Seed Nuclei

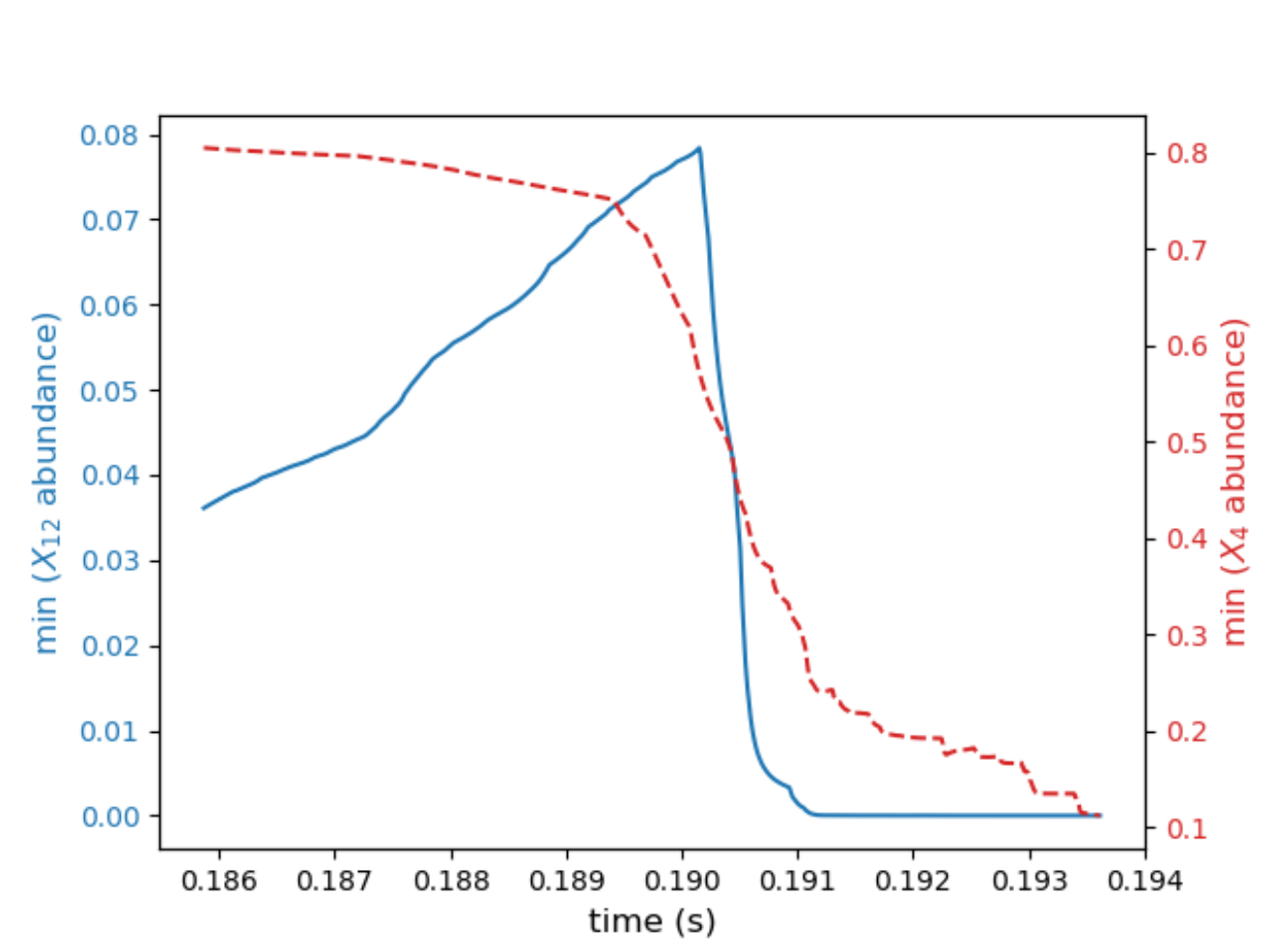


Detonation of 512^3 run with $\rho = 10^6 \frac{g}{cm^3}$ and He fraction $= 1.0$.

Slice Plots of Pure He Run



Local Abundances of He and C



Conclusion

Table: A table of runs with the different resolutions, densities, helium abundances, and mean temperature at the time of detonation initiation, $T_{\rm det}$ (K).

Resolution	Density (g cm^{-3})	Helium Abundance	$T_{\rm det}$ (K)
512^3	10^5	0.1	8.28×10^8
512^3	10^5	0.25	8.75×10^8
512^3	10^5	1.0	None
512^3	10^6	0.1	7.80×10^8
512^3	10^6	0.25	6.30×10^8
512^3	10^6	1.0	1.06×10^9