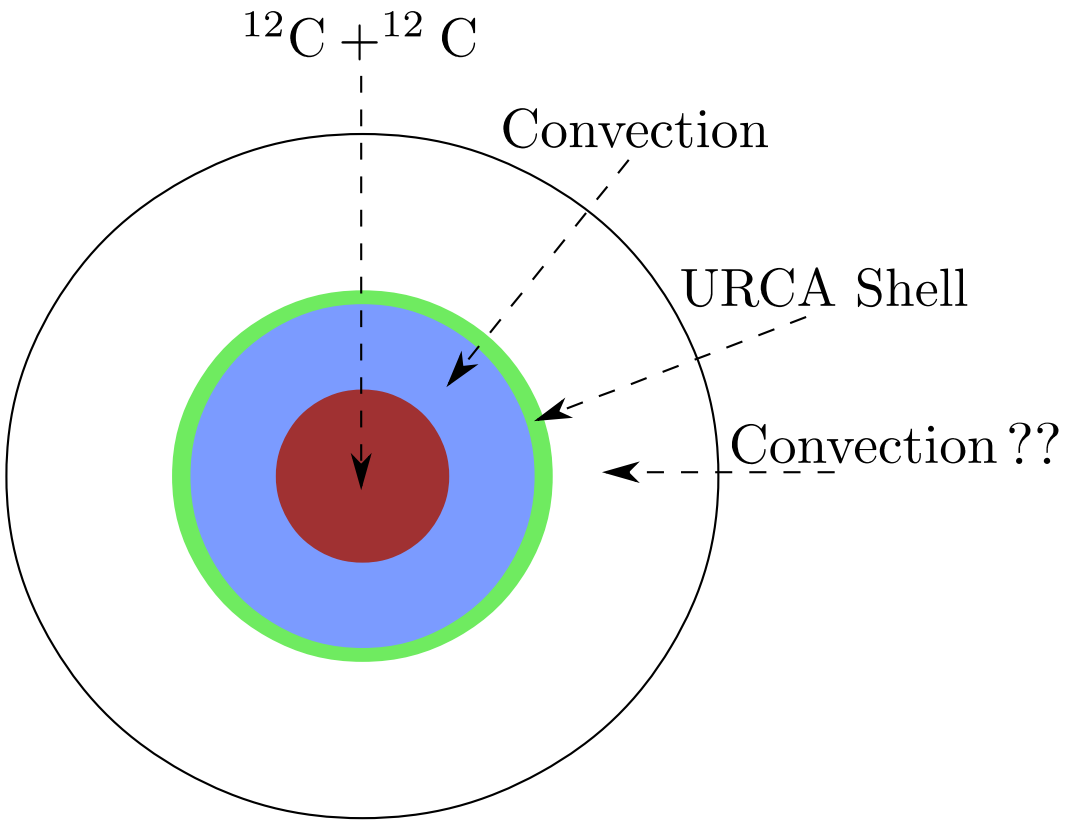
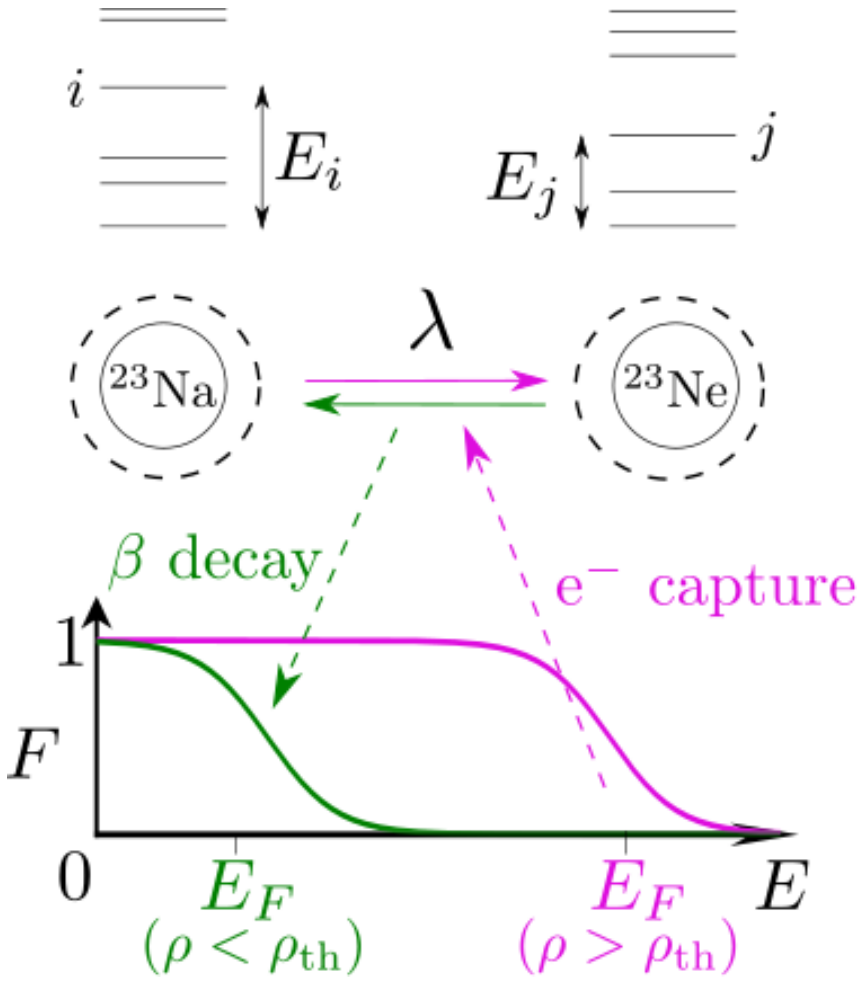
Urca Process In White Dwarfs





$$^{23}\mathrm{Na} + e^- \rightarrow \nu_e + ^{23}\mathrm{Ne}$$

$$^{23}\mathrm{Ne} \rightarrow e^- + \overline{\nu}_e + ^{23}\mathrm{Na}$$

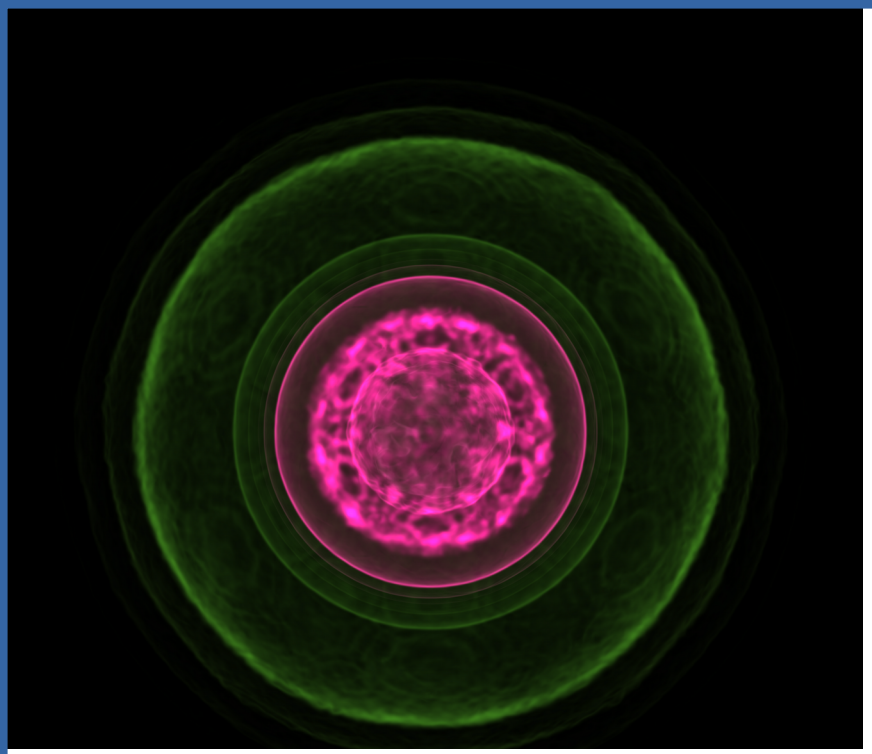
$$Q = 4.37590 \text{ MeV}$$

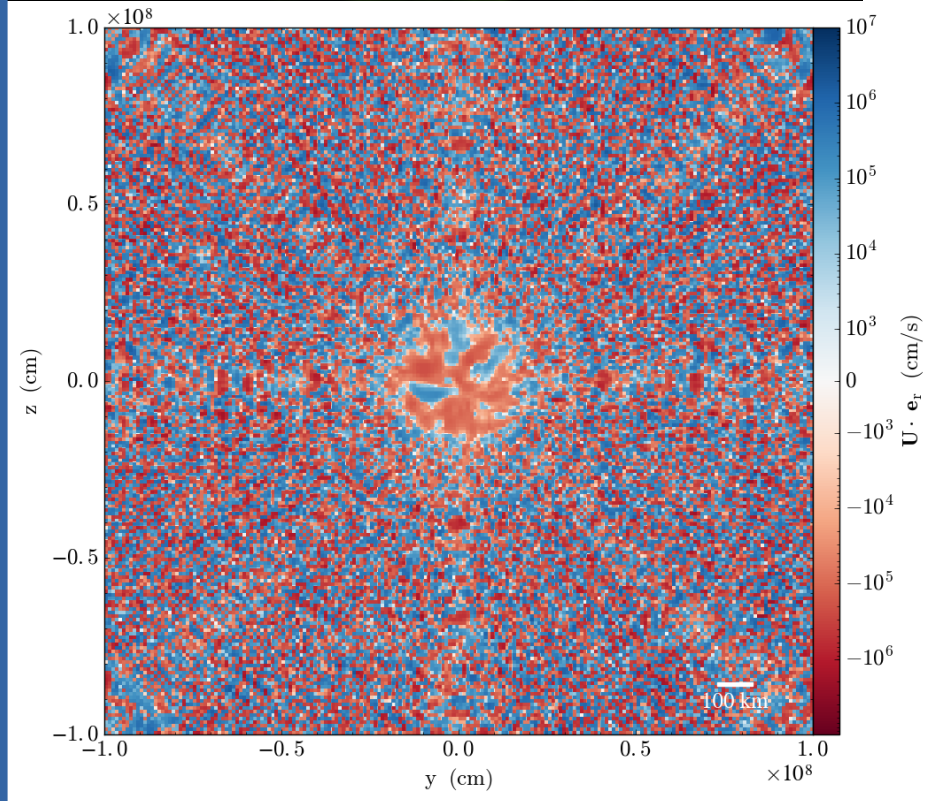
$$\mathrm{Log}_{10}(\rho Y_e) = 8.92$$

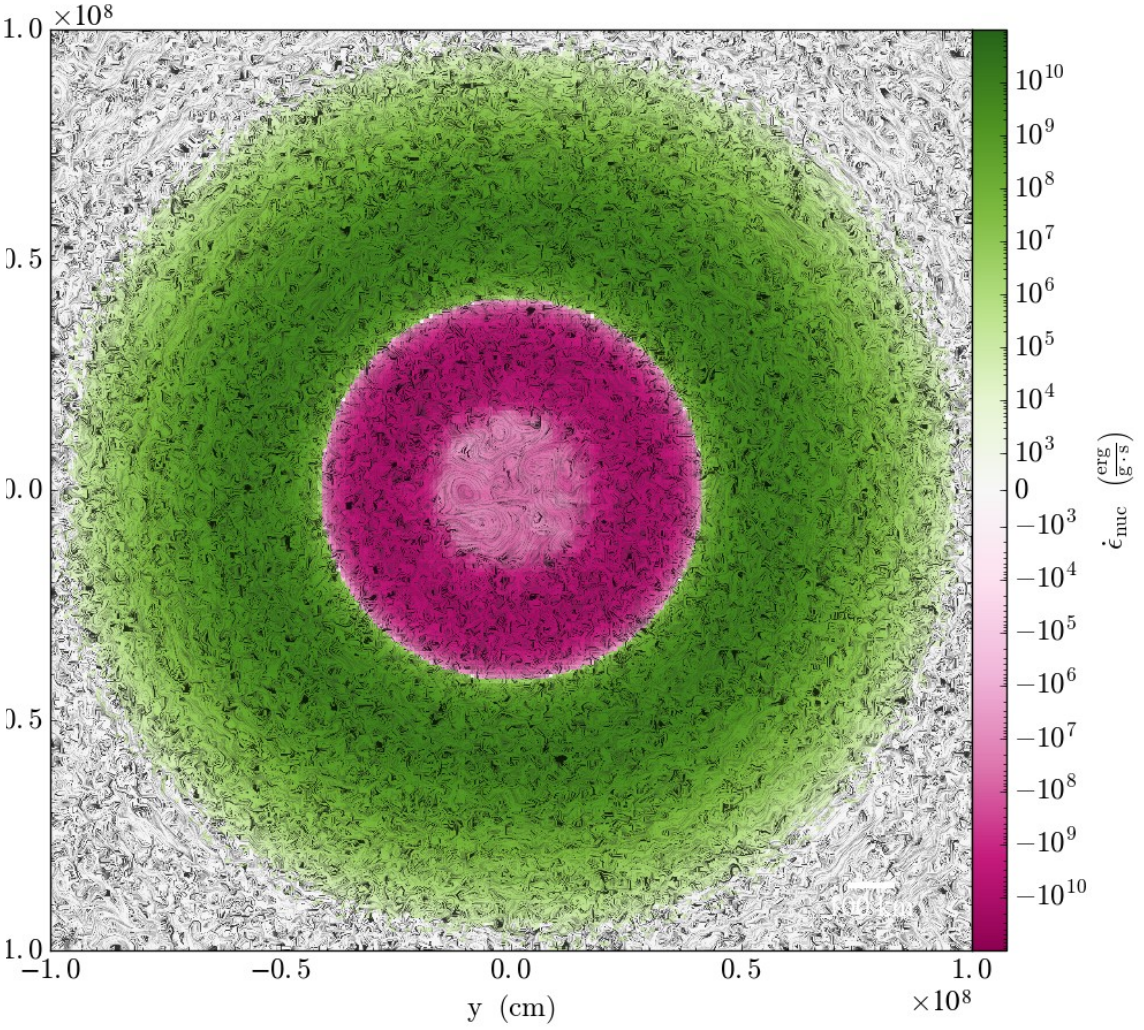
(Toki,Suzuki,Nomoto,Jones & Hirschi 2013)

White Dwarf Urca Process

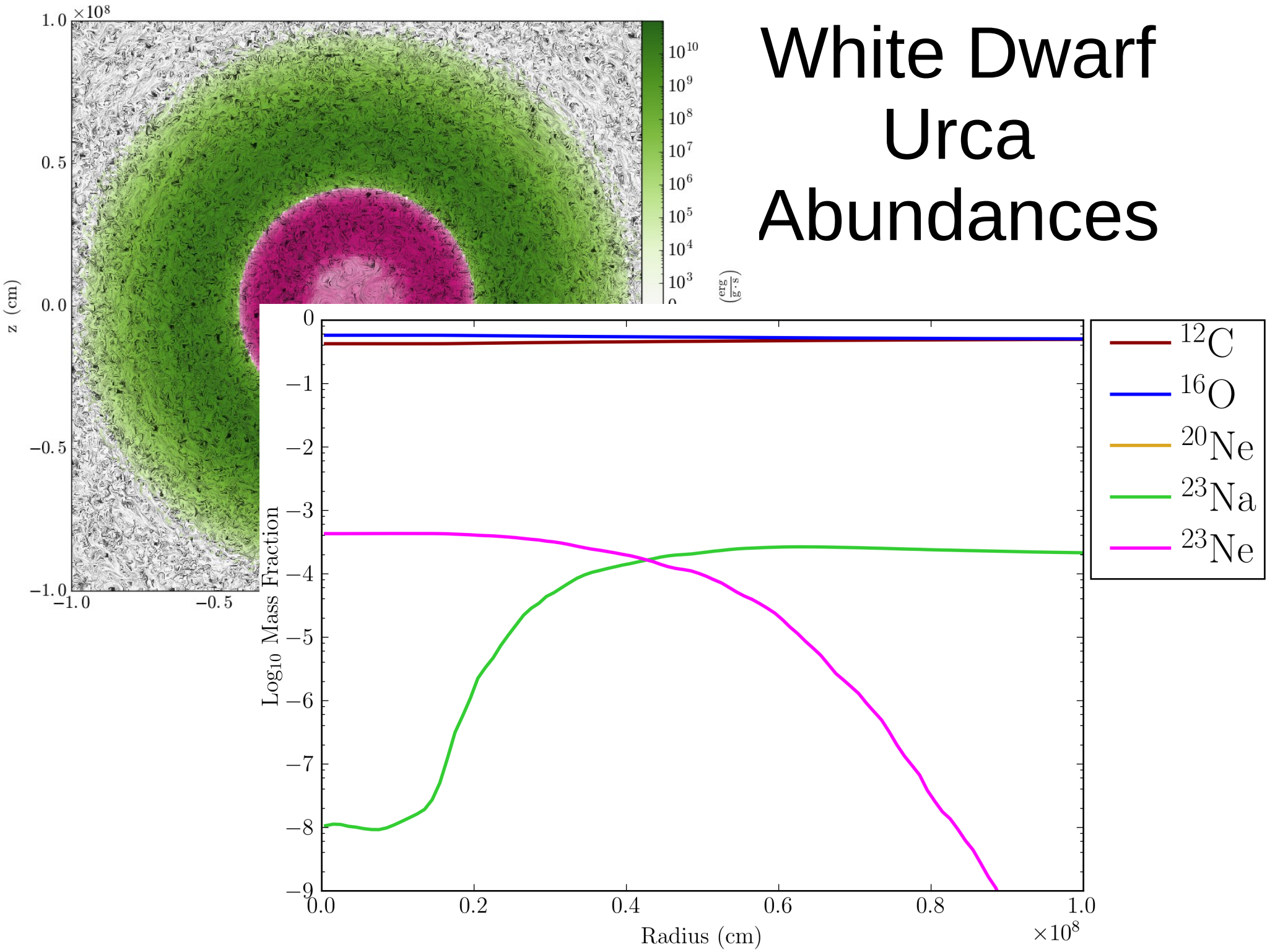
$$\rho_c = 4.5 \times 10^9 \ \mathrm{g \cdot cm^{-3}}$$
$$\mathrm{T_c} = 3.0 \times 10^8 \ \mathrm{K}$$







White Dwarf Urca Abundances



Project

- Use pyreaclib to construct a reaction network that links the nuclides that have a role in carbon fusion, electron capture, and beta decay.
- Determine the nucleosynthesis properties of the system and assess the dependence on:
  - Density
  - Temperature
  - Composition