Compositionally-driven convection in C/O white dwarfs interiors during crystallization

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Heat transport and convective velocities in compositionally-driven convection in neutron star and white dwarf interiors

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$$F_X = \dot{M}_c \Delta X_{\rm melt} / 4\pi R_c^2$$

An approach using the evolution of a $0.6 M_\odot$ WD in MESA.

Currently working on the MESA code to:
- Include the phase separation of the C and O (based on Bauer 2023)
- Modify the MLT routine to have a consistent description.

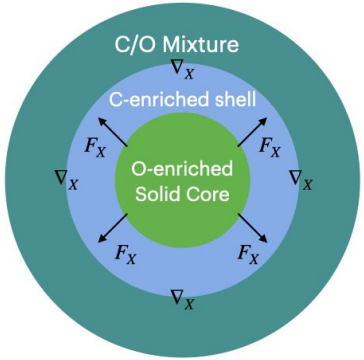
Liquid phase at the beginning

$\Gamma < \Gamma_{\rm melt}$

Stably-stratified thermally

$\nabla < \nabla_e \leq \nabla_{\rm ad}$

but still

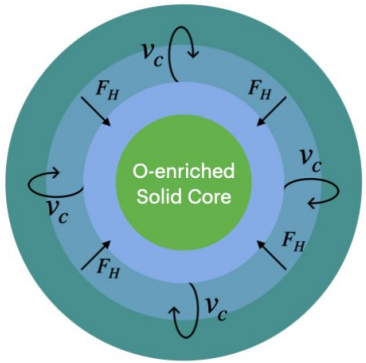


Crystallized in the core

$\Gamma > \Gamma_{\rm melt}$

Instability by $\nabla_X > 0$ due to $F_X > 0$

$$\nabla > \nabla_e - \frac{\chi_X}{\chi_T} \nabla_X$$



Convective motion mixes outwards

Inward heat flux $F_H < 0$

$$\frac{F_H}{F_X} = -\frac{c_P T}{X} \frac{\nabla_e - \nabla}{\nabla_X}$$