

## Key points 04/18 lecture

White dwarf:  $\text{He}^{++}$  and electrons

neglect kinetic  
energy of  
heavy nuclei

treat as free gas

→ Pauli exclusion principle leads  
to an effective repulsive force  
that stabilizes the system  
against gravitational collapse  
(attractive force due to system's  
own mass)

Roughly:

mass of Sun  
radius of Earth } extremely dense

temperature at center  $\approx 10^7 \text{ K} \ll$  Fermi temperature

⇒ highly degenerate  
system

Need to account for relativistic effects:

$$\text{single-particle energy } \varepsilon_{\vec{k},s} = \sqrt{(\vec{p}c)^2 + (m_e c^2)^2}$$

One can derive mass-radius relationship that  
predicts about the correct mass of  
White Dwarfs at collapse (close to Chandrasekhar  
mass).