

$$V = \frac{4\pi}{3} R^3$$

$$\left(\frac{4\pi}{3} R^3 \right) \frac{4\pi}{3} P_F^3 = N_e \frac{h^3}{2}$$

$$V_p = \frac{4\pi}{3} p_{\max}^3 = \text{Fermi}$$

$$N_e = \frac{\frac{4\pi}{3} P_F^3 \cdot 2 \cdot V}{(2\pi\hbar)^3}$$

$P_F = \text{Fermi momentum}$

$$= \frac{1}{3} \frac{P_F^3 \cdot V}{\pi^2 \hbar^3}$$

Sirius: $P_{FC} = 670 \text{ keV}$

$$P_F = 3 \sqrt{\frac{3\pi^2 \hbar^3 \cdot N_e}{V}}$$

$P_F = 670 \text{ keV}/c$

$[m_e \cdot c^2 = 511 \text{ keV}/c]$

$$= \sqrt[3]{3\pi^2} \hbar \sqrt[3]{N_e}$$

$pc = \gamma \cdot mc \cdot v/c$

$\gamma \cdot \frac{v}{c} = \frac{670}{511} = 1.3$

Non-rel.: $T_{kin} = \frac{p^2}{2m}$

$\gamma = \frac{1}{\sqrt{1-v^2/c^2}}$

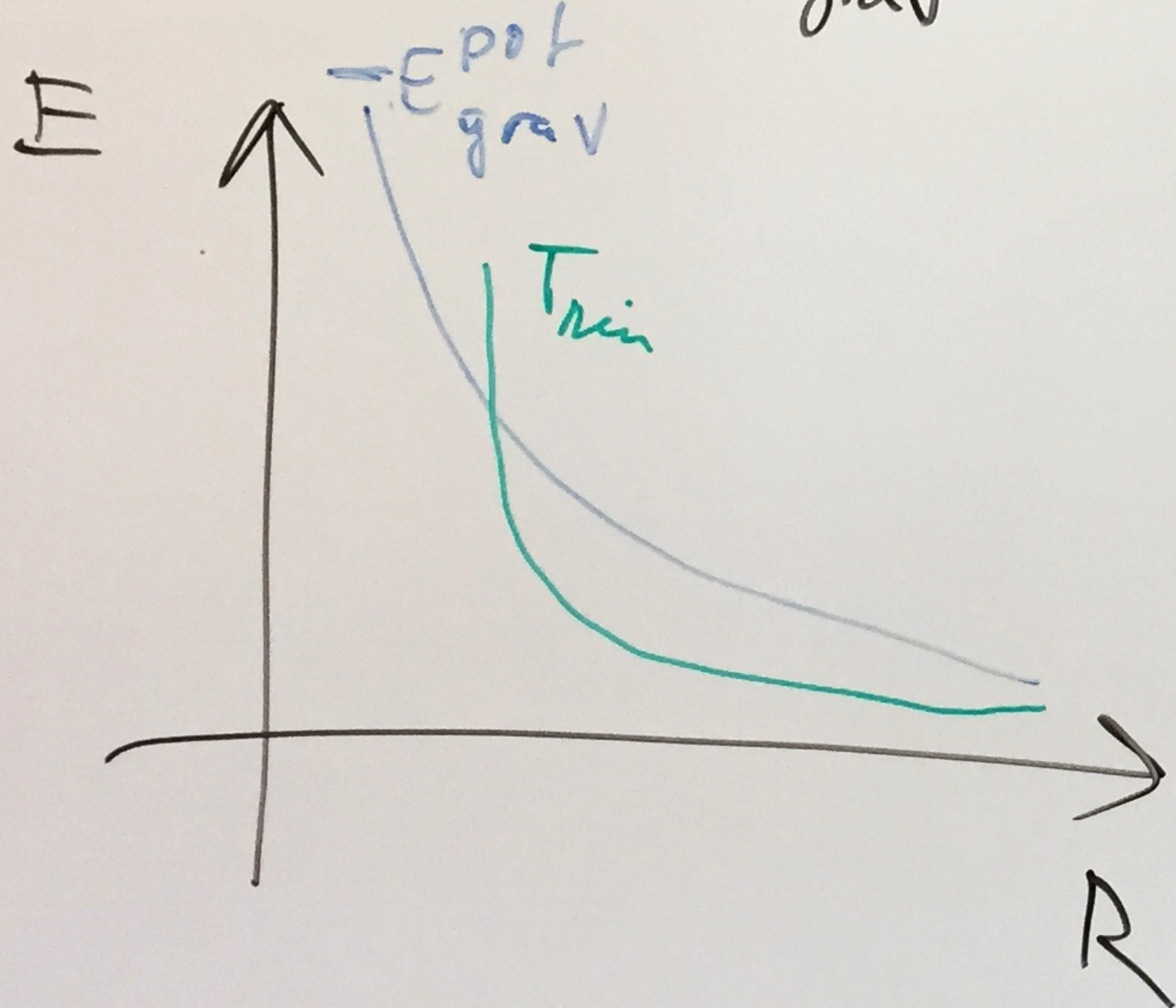
rel.: $E = \sqrt{m^2 c^4 + p^2 c^2} \approx mc^2 + \frac{p^2}{2m} + \dots$

n. rel. $E_{kin} = \frac{3\hbar^2 \left(\frac{9\pi}{4}\right)^{2/3}}{10 m_e} \cdot \frac{N_{tot}^{5/3}}{R^2}$

all e^- combined

extreme rel. $E_{tot} = \frac{3\hbar c \left(\frac{9\pi}{4}\right)^{1/3}}{4} \frac{N_{tot}^{4/3}}{R}$

Compare: $E_{grav}^{pot} = -\frac{3}{5} \frac{GM^2}{R}$



Weak interaction
 $n \rightarrow p + e^- + \bar{\nu}_e$