

Level 2 Stars

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Problem Set S.3

- (1) Estimate the temperature at the core of the star of pure Hydrogen using

$P_c = \frac{3}{8\pi} \frac{GM^2}{R^4}$. You should assume a constant mass density and also assume that the contribution from radiation pressure is negligible. Comment on whether nuclear fusion of Hydrogen is possible assuming classical mechanics?

[6 marks]

- (2) Calculate the temperature at which radiation pressure exceeds the gas pressure, assuming a particle density of $n=10^{32} \text{ m}^{-3}$?

[4 marks]

[star mass = $5 \times 10^{30} \text{ kg}$; star radius = $9 \times 10^8 \text{ m}$; $M_H = 1.67 \times 10^{-27} \text{ kg}$;
 $k = 1.38 \times 10^{-23} \text{ JK}^{-1}$; $a = 7.57 \times 10^{-16} \text{ Jm}^{-3} \text{ K}^{-4}$; $G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$]