Homework #8
Due Friday Dec 5

Homework is due by 5:00 pm on the due date. Late homework will not be accepted.

1. For a zero temperature Fermi gas:
   (a) Show that \( n = \frac{4\pi g}{(2\pi \hbar)^3} \frac{p_F^3}{3} \)
   (b) Find \( p_F \) in terms of \( n \).
   (c) What is the Fermi energy \( \epsilon_F \) in the non relativistic (NR) case?
   (d) What is the Fermi energy \( \epsilon_F \) in the extremely relativistic (ER) case?
   (e) Given that the pressure is:

\[
P = \frac{2g}{(2\pi \hbar)^3} \int_0^{2\pi} \int_0^{\pi/2} \int_0^{p_F} v_p p^3 dp \cos^2 \theta \sin \theta d\theta d\phi \int_0^{p_F} v_p p^3 dp
\]

find the pressure in the NR and ER cases in terms of the number density \( n \).
   (f) Find the energy density \( U \) in terms of the number density \( n \) in the NR and ER cases.
   (g) Show that \( P = (\gamma - 1)U \) in both the NR and ER cases

2. LeBlanc 6.2
3. LeBlanc 6.7
4. LeBlanc 6.15