## Homework # 1, due 17 Feb

1. Consider a non-interacting fermion gas. Derive the following formula for the entropy per baryon $s$

$$ns = -\frac{g}{h^3}\int \left[f \ln f + (1-f)\ln(1-f)\right] d^3p, \tag{1}$$

where $f$ is the probability that a given momentum state will be occupied:

$$f = \left[1 + \exp\left(\frac{E-\mu}{T}\right)\right]^{-1}. \tag{2}$$

Here, the energy of a non-interacting particle, in terms of its rest mass $m$ and momentum $p$, is

$$E^2 = m^2c^4 + p^2c^2, \tag{3}$$

and $\mu$ is the chemical potential. Show your work.
2. Determine the entropy per baryon of a room-temperature gas. Alternatively, you may compute the entropy density of a room-temperature gas. Show your work.
3. Determine the entropy per baryon or the entropy density at the center of the Sun. Show your work.