

Astrophysics of Compact Objects (171.156), Fall 2011

Problem Set 8

Due: In class, 8 November 2011

1. Frank, King, and Raine's problem 8.5
2. Frank, King, and Raine's problem 8.6.
3. If the redshift of detectable bursts is about unity, roughly estimate the rate of GRBs per galaxy (number/year). What is the energy/year/galaxy released by GRBs? Which of these two numbers is sensitive to the (unknown) distance to the bursts? Why is the other relatively insensitive?
4. A 1D gas is at rest in a box of length L . It has particles of rest mass m with number density n . Half of them are going in the $+x$ direction with Lorentz factor γ and half are going in the opposite direction with the same Lorentz factor (they are reflected once they reach the sides of the box).
 - (a) What is the pressure and the energy density of this gas.
 - (b) What is average distance l between particles moving in each direction.
 - (c) What is that distance in the rest frame of those particles?
 - (d) An observer moves relative to the box with Lorentz factor Γ , what does he think is the distance between the particles that are moving in each direction?
 - (e) What is the particle and energy density in the observer frame?