ASTR 680 Practice questions for lecture 4: Energy losses and gravitational radiation

1. The highest-energy particle accelerators (e.g., the LHC or Fermilab) always accelerate protons or other heavy nuclei. Why not electrons? There's a lot we could learn from the collisions of very high energy electrons.

2. A gravitational wave source at a distance r from a detector produces waves of frequency f and amplitude h at the detector. If the emission is approximately isotropic, use dimensional analysis to compute the luminosity in the waves.

3. The total energy released in a supernova is roughly 10^{53} ergs (most of this is emitted in neutrinos). Estimate the fraction of that energy that would need to go into 100 Hz gravitational waves to produce an amplitude $h = 10^{-21}$ at a distance of 10 kpc (i.e., within the disk of our Galaxy). Assume that the waves are emitted approximately isotropically.