Homework 12

Problem 1 (5 points)

Derive the exact formula for degeneracy pressure due to relativistic ($v = c$) fermions similar to eq. 16.15, though, express final answer via mass of fermion particle m_f and its density n_f. Assume temperature of the gas to be zero.

Problem 2 bonus (5 points)

The section 15.3 of the text book describes observations of SN 1987A neutrinos arrival. Neutrinos arrive to Earth 3 hours before photons hit the Earth. How would you explain that light, which is supposedly the fastest, was beaten by neutrinos?

Problem 3 (5 points)

A neutron star with $R = 10$ km and mass $M = 2M_\odot$ has observed luminosity of $L_\odot$. Assuming that we are far away from this star, find its luminosity at the surface of the star.

Problem 4 (5 points)

Solve problem 17.4

Problem 5 bonus (5 points)

Find the travel time for a photon to travel from the Sun surface to the Earth orbit applying the metric change due to gravity.

Now do the same but for a photon traveling to infinity. Does your result implies that the Sun is a black hole. Why so?