

Homework 13

Problem 1 (5 points)

Calculate the oscillation period of the Sun with respect to the galaxy disk. Assume that density $0.15 M_{\odot}/(\text{pc})^3$.

Problem 2 (5 points)

Using derivations of above problem, find the maximum deviation/height of the Sun above the galaxy disk median. Does the Sun belong to the thin or the thick disk? The current velocity of the Sun in direction away from the disk is $\omega_{\odot} = 7.2 \text{ km/s}$ and height above disk is $z_{\odot} = 30 \text{ pc}$.

Problem 3 (5 points)

A neutron star with $R = 10 \text{ km}$ 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. I.e. find the general relativity correction.

Problem 4 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?