

Homework # 6, due 22 Mar

1. Demonstrate that the temperature applicable to a stellar system is

$$T = \frac{m \langle v^2(\mathbf{x}) \rangle}{3k}$$

where it is assumed that the stars have equal mass m , $v(\mathbf{x})$ is the velocity of a star relative to the center-of-mass, and $\langle \rangle$ represents an average.

2. Calculate the gravitational potential a distance z from a sheet of matter with uniform surface density Σ , and show that the vertical force is independent of z .
3. In this problem, you are asked to compute the frequencies of the Sun's orbital excursions from its mean position perpendicular and parallel to the Galactic plane, ν and κ , respectively. You are to assume a Plummer model for the Galactic gravitational potential. Find the Plummer parameter a from the observed values of the Oort A and B constants,

$$A = 15 \text{ km s}^{-1} \text{ kpc}^{-1}, \quad B = -12 \text{ km s}^{-1} \text{ kpc}^{-1},$$

assuming the Galactocentric distance of the Sun is $R_0 = 8.5 \text{ kpc}$ and its circular velocity is $V_0 = 220 \text{ km s}^{-1}$.

Also determine the total mass of the Galaxy and the fraction which is interior to the solar circle. Explain the ratio κ/ν that you find.