Astronomy UN2002 | Spring 2020
Due Wed. Feb. 19 | Prof. J. Halpern

Homework #4

1. Assume that stars and gas in the Milky Way all move on circular orbits with velocity 220 km s^{-1} (a flat rotation curve). What will you observe for the velocity components v_r and v_t

   (a) at the tangent point along the line of Galactic longitude $\ell = 30°$?

   (b) at the tangent point along the line of Galactic longitude $\ell = 330°$?

2. What values would be measured for the Oort constants at $R_0 = 8$ kpc

   (a) in a galaxy that has a flat rotation curve of $\Theta = 220$ km s^{-1}?

   (b) in a galaxy that has a uniform angular velocity of $\omega = 27.2$ km s^{-1} kpc^{-1}?

   (c) in a galaxy that has all of its mass in a central point, and $\Theta_0 = 220$ km s^{-1}?

3. Referring to "Notes on measuring the rotation curve, and the Oort constants" on the course web page, derive Equation (8) starting from Equation (6), the second Oort equation. That is, starting from

$$v_t = (\omega - \omega_0)\, R_0 \cos\ell - \omega\, d, \tag{6}$$

   show that in the limit $d << R_0$,

$$v_t \approx d\,(A \cos 2\ell + B). \tag{8}$$

   Hint: Use the same approach that was applied in the notes when approximating the first Oort equation (for v_r) in the limit $d << R_0$.