Astronomy 312 - Fragile
Homework 3 (assigned 1/26/16; due 2/2/16)

(2) 1. (a) The absolute magnitude of M101, an Sc galaxy, is -21.51 in the B band. Using Eq. (25.11), estimate its isophotal radius (R_{25}) at 25 B-mag arcsec^{-2}.

(2) (b) Use the Tully-Fisher relation (Eq. 25.7) to estimate the rotational velocity of M101.

(2) (c) Estimate the angular rotation speed of a star at R_{25}, in units of arcsec yr^{-1}.

(2) (d) Could van Maanen have detected the rate of rotation of M101? How long would it take for the galaxy to rotate through 1″?

(4) 2. Neglecting the effects of extinction and the K-correction, show that the surface brightness of a galaxy is independent of its distance from the observer.

(2) 3. (a) From the data shown in the figure below for the stellar velocity dispersion near the center of M31, estimate the amount of mass within 1″ of the center of the galaxy.

(2) (b) Estimate the amount of mass within the central 1″ based on the rotational velocity data.

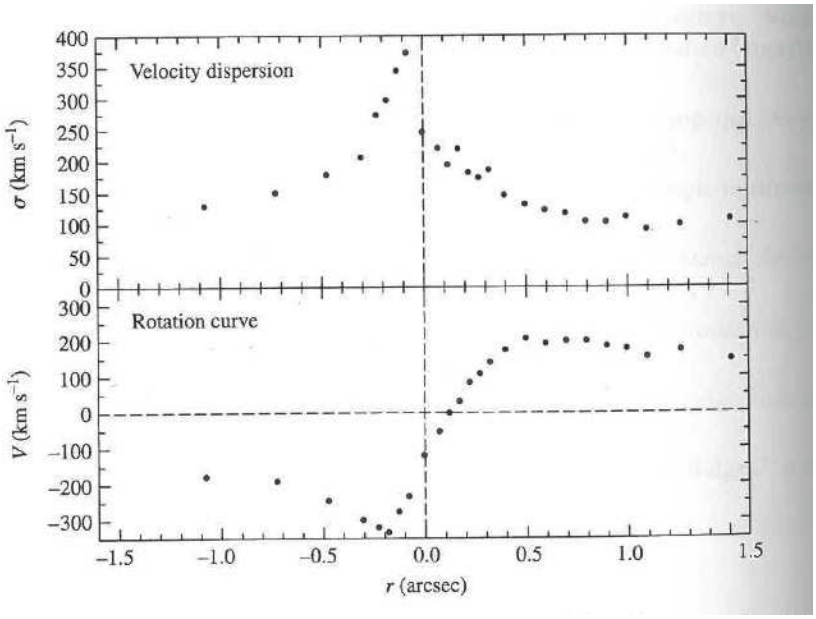

Figure 1: The stellar velocity dispersion and rotational velocities of stars near the center of M31, measured along the major axis of the bulge. Given the distance to Andromeda of 770 kpc, 1″ corresponds to a linear distance from the center of 3.7 pc.