Astro 430/530 GALAXIES

Problem Set #2 (on SB and LSB disks)
Due Monday January 29, 2018

1a.) In a galaxy at distance of \( d \) Mpc, what would be the apparent B-magnitude of a star like the Sun?

b.) In this galaxy, show that 1” on the sky corresponds to 5\( d \) pc.

c.) If the surface brightness \( I_B = 27 \text{ mag arcsec}^{-2} \), how much B-band light does one square arcsecond of the galaxy emit, compared with a star like the Sun? In other words, what is the surface brightness of the Sun in mag arcsec\(^{-2} \)?

d.) If galaxy light comes from stars like the sun, what fraction of the area of a galaxy is filled with the surfaces of stars, for a region of the galaxy with \( I_B = 20 \text{ mag arcsec}^{-2} \)?

e.) Derive the relationship between surface brightness in magnitudes arcsec\(^{-2} \) and surface brightness in \( L_{\sun} \text{ pc}^{-2} \). (I want you to derive this & and not just look it up!) Start from the relations between surface brightness in mag arcsec\(^{-2} \) and flux, absolute magnitude and luminosity, and apparent and absolute magnitudes.

f.) Show that the surface brightness of \( I_B = 27 \text{ mag arcsec}^{-2} \) is equivalent to 1.0 \( L_{\sun} \text{ pc}^{-2} \) in the B-band, but that \( I_I = 27 \text{ mag arcsec}^{-2} \) corresponds to only 0.3 \( L_{\sun} \text{ pc}^{-2} \) in the I-band.

2. SG 5.4 (LSB gals)
NOTE: Please plot \( R_{25} \) vs. \( I(O) \) on a log scale, so the behavior at low \( I(O) \) is clear.