Selection of Homework Questions

Next Prev Print

Topic 3: Catalogs and Global Parameters

(1) Global Parameters.

This question helps you work with a number of global galaxy parameters, taken from the RSA and RC3 catalogs, both of which can be found in the Library. The introductory notes for the RSA can also be found here while a relevant subset of the introductory notes to RC3 can also be found here (pp 77-11, 30-32, 44, 50-52, 54-55). Although the catalog data entries for RC3 can all be found on the NED website here, the full RSA catalogue data need to be obtained from the printed copy.

a. Construct a single table which allows you to compare entries in the RSA and RC3 catalogs for the following galaxies NGC 976, 1097, 3900, 5074, 7371 (don't worry about uncertainties for the quantitative values). Include only the following parameters:

- morphological type, (unpack the RC3 morphology code into the normal form using this table from p15 in RC3).
- total blue magnitude, B_T
- galactic absorption,
- internal absorption,
- corrected total blue magnitude, $B_T^{o,i}$ (in RC3 this is the weighted mean of the corrected values for photoelectric B_T and photographic m_B).

b. **Morphology:** Are the differences in morphological type between the two catalogs greater or less than you expected, and why?

c. **Extinctions:** For NGC 976, use the methods given in the introduction to RC3 (p30-31) and RSA to calculate the **internal** absorption A_i for each catalog. Why are the internal absorptions in the RSA and RC3 **systematically** so different (don't just cite the equations for deriving them, but look up the philosophy of the two catalogs)?

Find the **galactic** extinction, A_g, using the link given in Topic 3.7d (here) to find A_B (= A_g) at the location of the galaxy (use the 2011 values; the value differs slightly from the value in RC3 because RC3 uses an earlier version of the methods used in the link). Why does A_g differ for the RSA and RC3? Which do you think is more accurate?

Why do galaxy magnitudes require a "K-correction" for redshift. Evaluate the K-correction for NGC 976 (see pp 44 in the RC3 intro). Why is it so small for this galaxy?

d. **Redshifts:** What are the differences between the four redshifts given in RC3: V_{21}, V_{opt}, V_{GSR}, and V_{3K} ? **Derive** (i.e. don't just copy) an expression which converts V_{opt} to V_{GSR} for a galaxy with galactic longitude and latitude, *l* and *b*, and a solar motion relative to the LSR (16.5 km/s towards $l = 53°$ $b = +25°$) and the LSR's orbital motion (220 km/s towards $l = 90°$ $b = 0°$). Which redshift would you use to measure the distance to a galaxy that has cz ~ 1000 km/s, and one that has cz ~ 10,000 km/s?

The next four parts ask you to calculate some intrinsic properties of **NGC 1097** using information from RC3:

e. **Blue luminosity:** Use the value for $B_T^{o,i}$ from RC3 to calculate the galaxy's blue luminosity, L_B, in solar units $L_{B,\odot}$? (Note: for the sun, $M_{B,\odot} = 5.48$).

f. **Total (dynamical) mass:** Use the hydrogen line width, W_{20}, to calculate NGC 1097's rotation amplitude, V_{rot} (note: W_{20} gives **twice** the observed rotation speed; and don't forget to correct for inclination, which you can get from R_{25}). Now use D_{25} (check its units, see pp 8 of the RC3 notes) to estimate the size (radius) of the galaxy, in pc, and from this and V_{rot} calculate a total mass interior to D_{25}.

g. **Total Mass to Light Ratio:** From the dynamical mass and the blue luminosity, find the total M/L_B ratio for the galaxy. Is this reasonable?

h. **Neutral Hydrogen:** Use the HI data (m_{21}) to evaluate the neutral hydrogen mass (in $M_\odot$). Don't forget the HI absorption, A_{21}, and you'll need to use the relations given in page 51 of the RC3 introduction to convert the HI magnitude to HI flux, S_H, and then to the HI mass. Finally, what's the **hydrogen** mass to light ratio: M_{HI}/L_B in solar units. Does this seem reasonable? [Note : DON'T use equation 78 on p 51 in RC3, which is **incorrect**.] Roughly, what fraction of the total dynamical mass is in neutral hydrogen? Does this also seem reasonable?

(2) Exploring the SDSS database.

An exercise that helps you become familiar with the Sloan Digital Sky Survey database can be found here: .doc file or .pdf file.
