Assignment 1

Astronomy 4202/5202

Assignment: Due Wednesday, January 18, in class

You must show your work.

1. Derive Wien's displacement law in terms of frequency (10pt).

2. Problem 1.8 (10pt) **Note: use Table 1.5 instead.**

3. Problem 1.11 (the reference to the previous problem in the second paragraph is actually the problem given in the first paragraph) (20pt) **Note: Typos in the text book.** $\kappa = 0.0084$ cm^{-1} **and thickness of** 120 cm **instead of** 70 cm. **Use** $\kappa = n\sigma$.

4. Two galaxies have identical B-band magnitudes of $m_B = 20.0$. We know that galaxy 1 is at twice the distance from us as galaxy 2, and that both galaxies have a thin screen of dust in them which gives them an optical depth of $\tau_B = 0.6$ and that we see both galaxies face-on. (20 pts)

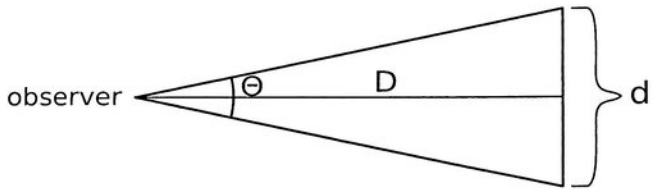
(a) What is the apparent B-band magnitude of both galaxies combined?

(b) What is the difference in the absolute B-band magnitudes of the galaxies?

(c) What would be the apparent magnitude of galaxy 2 if there was no dust present?

(d) If both galaxies are along the same line-of-sight (ie, the light from galaxy 1 passes through galaxy 2 to reach us), what would the be apparent magnitude of galaxy 1 if no dust was present in either galaxy?

5. The questions below require converting from an angle on the sky to the transverse physical distance at some large radial distance from the observer. Formally, you would think that this might involve trigonometry, e.g., that the transverse distance d is the radial distance D times $2\tan(\theta/2)$, where θ is the angle. However, in astronomy, we are nearly always in the $\theta \ll 1$ limit, so these formulae can be excellently approximated as $d = D\theta$ (with θ in radians). (20pts)



a) The galactic center is about 8 kpc away from the Sun. What physical separation there would correspond to 1 arcsecond of angle? Give your answer in cm and in Astronomical Units. Hint: be sure you understand why the latter answer is simple!

b) The Virgo cluster is the nearest mid-sized galaxy cluster to the Milky Way. It is about 18 Mpc away. If one wanted to resolve a 8 kpc distance in a galaxy there (i.e., to resolve a Milky-Way twin), what angular resolution is required? Give answer in arcseconds.

c) Very distant galaxies tend to appear to be 1.5 Gpc away (we'll explain this weird fact later in the course). Now what angular resolution corresponds to a physical separation of 8 kpc?

6. Problem 1.14 (20pt. Graduate only). Note: Try $d = 1$ Mpc and $d = 10$ Mpc, respectively, to calculate the B-band light from the galaxy.

Assignment 6

Astronomy 4202/5202

Assignment: Due Monday, Mar 7, in class

Problem 1 (20 pts):

1. Problem 6.7 (20 pts) p. 258
2. Problem 6.9 (20 pts, hint: at one point you'll need to multiply the entire equation by v) p. 264
3. Problem 7.2 (20 pts) p. 280
4. Problem 7.5 (20 pts) p. 283
5. Problem 7.6 (20 pts. Graduate student only. Extra credit for undergraduates. Note that you don't need to derive $F \sim 0.4$.) p. 286

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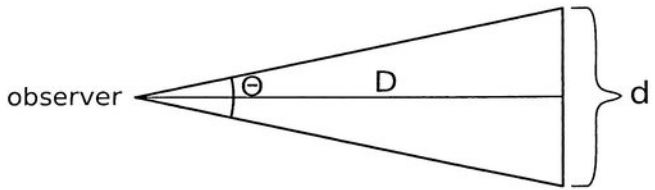

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