Astronomy & Astrophysics I. Quiz 1 (Fri Sept 16th, 2011)

The bright star Sirius has played a major role in the development of astronomy from the earliest times right up to the present day. Telescopes reveal a close companion, which orbits Sirius with a period of 50 years. The distance between the two stars varies between 3 and 11 arcseconds over that period.

1. Sirius A's Spectrum peaks at $\lambda \approx 300$ nm. Calculate the effective surface temperature T_A in Kelvins. [2]

2. The faint binary companion, Sirius B, has a spectrum that peaks at $\lambda \approx 115$ nm. Calculate T_B [1]

3. Observations of Sirius using telescopes equipped with cameras, (i.e. images) show that star A is about 1000 times brighter than star B, yet both stars are effectively at the same distance from Earth. What is the ratio of their luminosity L_A/L_B ? [2]

4. Now can you estimate the ratio of their physical radii ? [5]

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5. We can also compare the brightness of Sirius to that of the Sun. Due to its immense distance (8.6 ly), the measured flux of Sirius is much smaller. The approximate ratio is $f_{sun}/f_A = 1.29 \times 10^{10}$. Determine the luminosity of Sirius L_A in terms of the Sun's luminosity L_{Sun}.. Which is intrinsically brighter? [5]

6. What minimum diameter telescope would be needed to resolve Sirius into two stars? [3]

7. For a telescope with 5m focal length, how far apart are the two stars in the image recorded on the detector? [2]

If you finish all this, feel free to compute the size of Sirius A compared to the Sun! [bonus 2]