Ay 192 — Problem Set 2

Due Nov 3rd, 1999

Problem 1. Roughly speaking, without adaptive optics, what is the effective limiting magnitude for rapid guiding at a site like Mt. Wilson where the Fried's parameter, r_0, is of ther order of 40cm? State your assumptions in making this estimate.

Problem 2. Suppose you are observing with the spiffy new 10 degree wide-field 6.5 meter Schmidt telescope, and, lucky for us, its been located at Mt. Hopkins. The good news is that the telescope produces very good images (the seeing turns out to be extraordinary so 0.1" images are normal). The bad news is you desperately need to take a 1 hour long exposure of the galactic center in the V band. How badly distorted will your images be at the top and bottom of the field, assuming you can take the exposure when the GC is +/- 1/2 hour from the meridian. What will they look like, what's the scale? Assume you're guiding on a star at the center fo the field, so the center comes through undistorted.

Problem 3. The sky brightness in the optical is usually measured in a certain number of magnitudes per square arcsecond. In the U-band (3600 Å) and R-band (7000 Å) the quoted numbers are 20.7 mag/sq" and 21.0 mag/sq", respectively. What photon rate (counts/second) would you expect from the sky in a 1000 Åbandpass centered on these wavelengths in a 1" round aperture on the converted MMT? Remember to calculate the telescope throughput completely. What would they be on HST?

Problem 4. What is the airmass of Arcturus observed from Cerro Tololo when the sidereal time is 14^h00? When the sidereal time is (b) 18^h30; (c) 22^h20? How much fainter (in magnitudes) will it appear at 3500Åat each of those airmasses relative to the zenith and to outside the atmosphere? (d) What is the minimum airmass of the north galactic pole at Cerro Tololo? The north ecliptic pole?

Problem 5. How big are the differences between the Cardelli, Clayton and Mathis extinction law and van de Hulst's curve #14?