ELEG 867 - Devices for Light Detection from the Submillimeter to the Ultraviolet – Fall 2009

Homework #1 - due Friday, 11 September 2009, in class

Radiometry calculations

1. Consider the apparent brightness as seen from earth of the full moon, compared to the moon when half illuminated – the so-called first or last quarters. Assuming that the moon is a Lambertian source (of reflected sunlight), calculate the ratio of measured received intensity (or detector irradiance E) of the full moon to that of the quarter moon. Assume that the earth sun and moon are in-line, and that the illumination from the sun is uniform per projected area of the moon. The hint is that the lit area near the light-dark terminator receives only a glancing illumination from the sun, varying as the cosine of the angle from the illumination to the line of sight. The correct Lambertian ratio is somewhat less than half, as you will find. In fact, the actual measured value is about 1/10, indicating that the moon is not Lambertian, which is attributed to small glassy particles that behave as retro-reflectors.

2. Consider the intensity and brightness of the full moon versus position across its surface. Give the functional dependence of the irradiance from the sun onto the actual (not projected) surface. Assuming again that the moon is Lambertian, give the dependence of perceived intensity versus position along the moon’s disk. Now compare an image of the moon with an ideal Lambertian disk (below). The Lambertian disk exhibits a phenomenon know as “limb-darkening”. Discuss your result in terms of problem 1, above.

Homework assignments will appear on the web at:
http://www.ece.udel.edu/~kolodzey/courses/eleg867f09.html.

Note: On each homework and report submission, please give your name, the due date, assignment number and the course number.