ASTR 407/507, Assignment 6 Due 2017/03/21, 10AM

1. Text probelm 6-3. For (a), express this energy loss rate as a fraction of the absorbed solar radiation, explaining any assumptions you make.

2. Text problem 6-14 from the book. Use equation (6.6) rather than the one given in class. Note that all quantities in (6.6) are in mks units.

3. The file (available on the ASTR 407/507 course web site)
   LOLAlargeCraters.txt
   provides a list of all craters (Longitude Latitude Diameter) with D>20 km as measured by the Laser Altimeter (see Head et al 2010, Science 329, 1504). The Longitude is +/- 180 degrees as measured from the Moon's average sub-Earth point (that is, the lunar equator in the middle of the nearside).

   a) Produce a plot of the longitude (x axis) vs latitude of the centers of all these craters. Consulting a surface map of the Moon, indicate where Mare Imbrium and the Orientale basin are on your plot.

   b) Because the lunar mare are heavily concentrated to the equatorial regions, there is a deficit of equatorial craters, which were filled in by basaltic flooding after they formed. Construct a histogram (using 5-degree bins) of number of craters versus latitude. Estimate a constant C such that when you overplot C*cos(latitude) you roughly fit the 'wings' of this, thus compensating for mare flooding near the equator. Explain what physical effect is producing this roughly cosine behaviour in crater density. Using your value of C, estimate the number of craters larger than 20 km that have been accumulated per square kilometer of the Moon (which thus neglects crater erasure due to saturation), and extrapolate to the entire lunar surface, over the age which it has been accumulating craters.

   c) Create a histogram of log(N) versus log(D) (base 10) and plot it from D=20-300 km with fixed 20-km linear bins, thus producing the *differential* crater distribution for this size range. Taking a power-law index Q in a *cumulative* relation $N(>D)=K D^{-Q}$, superpose the linear relation (on your differential log-log plot) corresponding to the cumulative Q=2, showing how you derive the value of K, which you should peg at D=30 km (the center of the 20-40 km bin). If you extrapolate, to order of magnitude how many D>1 km craters would your relation predict have formed over the entire lunar surface?