Unit 11 ATM401, ATM601 and CHEM601

Application, analysis, and evaluation

1. Undergraduate students: Determine the energy emitted per photon, the frequency, and the wave-number of $\lambda = 0.5\mu m$ and $\lambda = 10\mu m$ wavelength.

2. Undergraduate students: On June 21 and December 21, the distance Earth-Sun amounts $1.52 \cdot 10^8 km$ and $1.47 \cdot 10^8 km$, respectively. Calculate the total irradiance at the top of the atmosphere on these days. What is the absolute and relative variance in irradiance?

3. All students: Calculate how long it takes energy emitted from the Sun to reach Mars. The distance to Sun is $\approx 249 millionkm$ at the aphelion.

4. All students: Assume that the surface of Venus has a temperature of $475^o C$. Assume the average surface temperature of the Sun equal to $6000K$. How much radiation is emitted from the Sun's surface? Assume that the Earth's average surface temperature is $288K$. Determine how much radiation will be emitted if the Earth's blackbody temperature is $255K$. How many times warmer is the Sun than Earth or Venus? What are these number raised to the fourth power? Is the ratio of solar/Venus emitted radiation equal to the result? The peak wavelength of the energy emitted by the Sun is about 0.5 microns, what would the surface temperature of the Sun be in this case? What does this temperature change mean for the wavelength? Determine its peak wavelength of emitted radiation. Compare your results for Venus, Earth and Sun.

5. Graduate students: We learned that the solar constant is actually a function of the distance from the Sun. The solar radiation at the top of the atmosphere can be calculated as a function of latitude, time of the day, day of the year. Determine the solar insolation at the top of the atmosphere for 65N for each day of the year at noon. Hint: Use an excel spread sheet.