HW #3—Radiation

1. How is the Stefan-Boltzmann Law obtained mathematically from the Planck Function? What does this represent graphically? What does it represent physically?

2. If an object is 3 times warmer than a cool object, how many times more radiant energy does it emit in comparison to the cooler object?

3. How is Wien's Law obtained mathematically from the Planck function? What does this represent graphically? What does it represent physically?

4. If barbecue coals on your grill are burning at 627^{o}C, what is their wavelength of maximum radiation emission (in micrometers)? In words, what part of the spectrum does this represent?

5. For question "4" if $\lambda_{\max}$ is **not** within the visible part of the spectrum, how is it that we see the coals glowing red or orange?

6. Real objects do not emit the full amount of radiation predicted for blackbody emission by the Planck Function. They emit some percentage or fractional amount of that radiation determined by their emissivity (e_λ):

$$E_\lambda = e_\lambda \cdot E_\lambda *$$

where E_λ is the actual amount of radiation emitted and is what would be measured by a passive remote sensing instrument, and $E_\lambda *$ is the blackbody emission given by the Planck Function. Based on HW#2 where you inverted the Planck Function solving for "brightness temperature," write an expression for the brightness temperature that includes the emissivity. **Hint: Substitute for the Planck Function in the above equation, *then* solve for the temperature.**