ME 301

CONDUCTION AND RADIATION HEAT TRANSFER

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Review of previous class

- Different types of bodies
- Kirchhoff's Law
- S-B Law

Today's Topic

- Planck's Law
- S-B law and Wien's Displacement Law from *Planck's Law*
- Various feature of Blackbody radiation

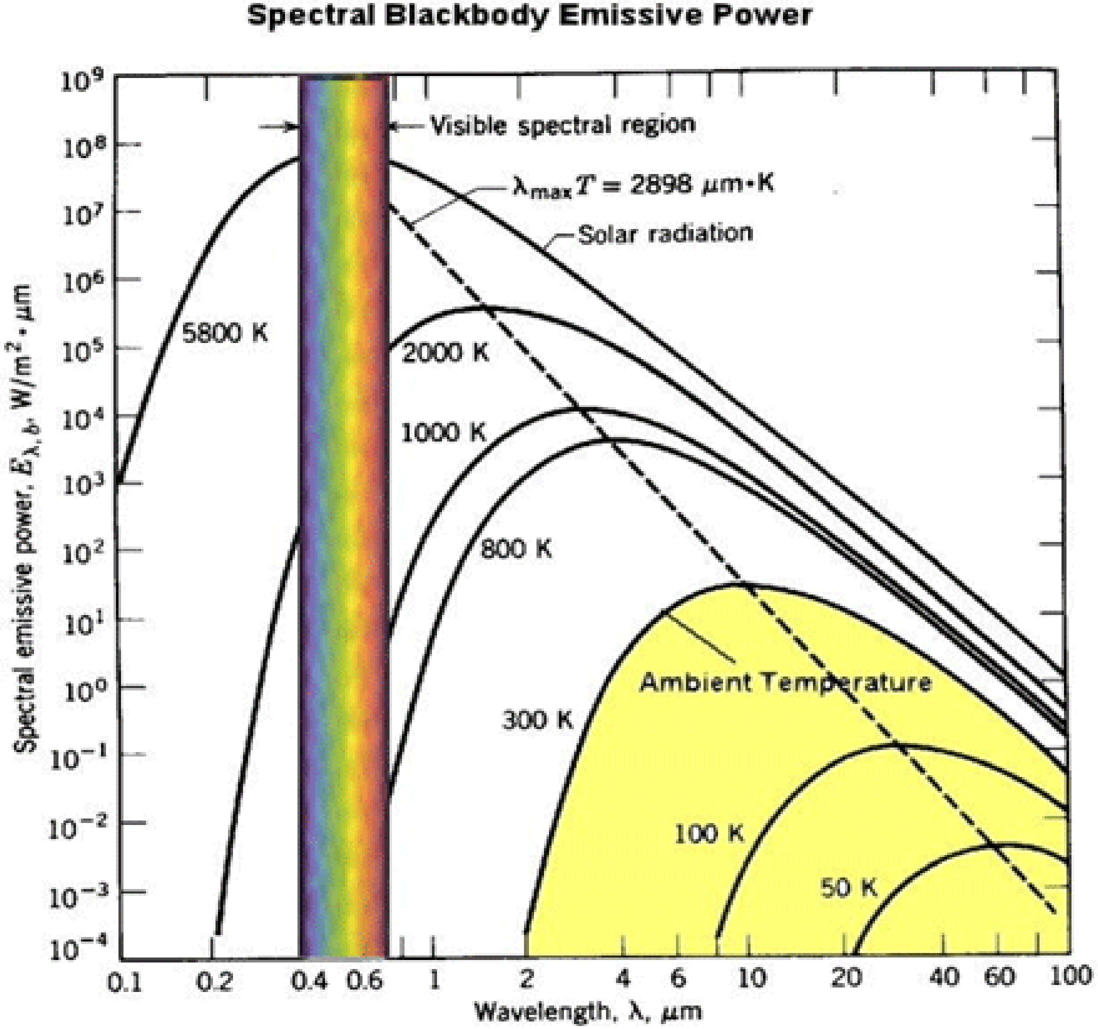
PLANCK'S LAW

- For a black surface bounded by a transparent medium with refractive index *n*, ***Planck's Law*** *is*

$$E_{b\nu}(T,\nu) = \frac{2\pi h\nu^3 n^2}{c_0^2\left[e^{h\nu/kT} - 1\right]},$$

- **DERIVATION OF S-B LAW FROM *PLANCK'S LAW.***
- **DERIVE WIEN'S DISPLACEMENT LAW FROM *PLANCK'S LAW.***

BLACKBODY EMISSIVE POWER SPECTRUM



SALIENT FEATURES OF PLANCK'S LAW

- The emitted radiation is continuous function of wavelength. At any specified temperature it increases reaches a peak and then decreases with increasing wavelength.
- At any wavelength the amount of emitted radiation increases with increasing temperature
- As temperature increases, the curve shifts to the left to the shorter wavelength region. Consequently a larger fraction of radiation is emitted at shorter wavelengths at higher temperature.

SALIENT FEATURES OF PLANCK'S LAW (CONT.)

- The significant amount of radiation emitted by the sun which may be approximated as blackbody at 5777K, the visible region of spectra..
- The area under the monochromatic emissive power vs wavelength at any temperature gives the rate of radiant energy emitted within the wavelength interval, dλ

$$dE_b = E_{b\lambda} d\lambda$$

$$E_b = \int_0^\infty E_{b\lambda} d\lambda$$

THAT'S ALL ABOUT TODAY.....