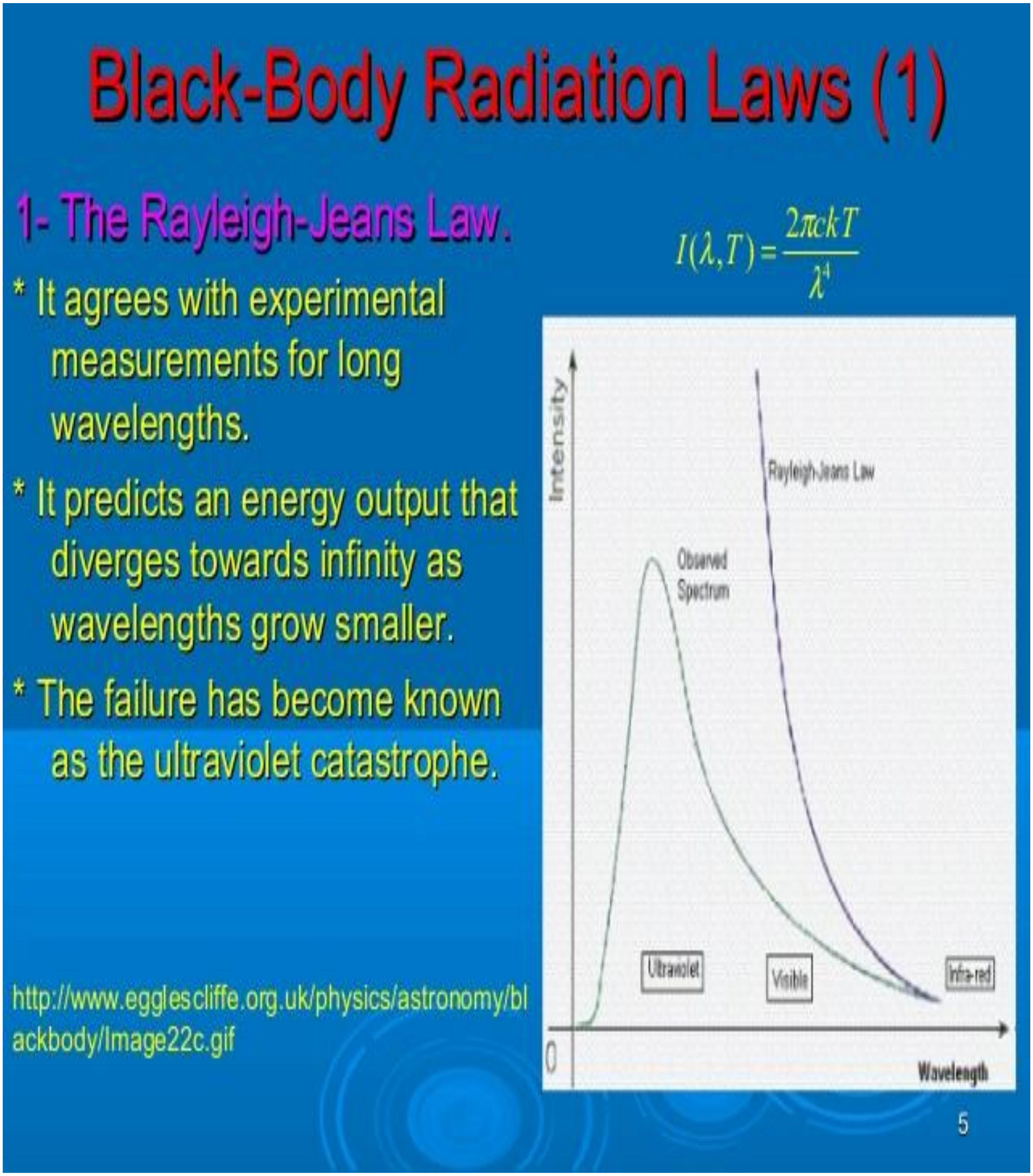


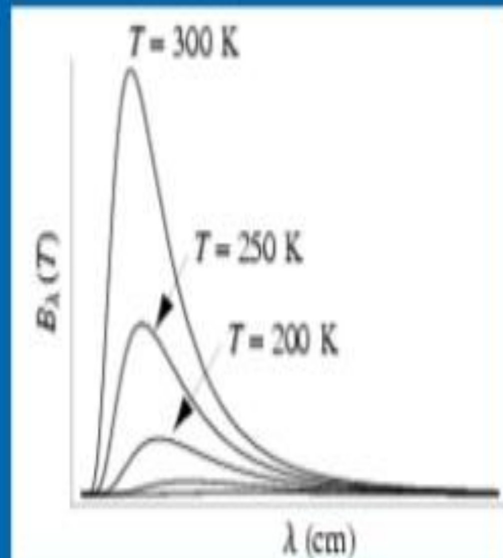
Black-Body Radiation Laws (1)
1- The Rayleigh-Jeans Law.
$I(\lambda,T)=\frac{2\pi ckT}{\lambda^4}$
* It agrees with experimental measurements for long wavelengths.
* It predicts an energy output that diverges towards infinity as wavelengths grow smaller.
* The failure has become known as the ultraviolet catastrophe.
http://www.egglescliffe.org.uk/physics/astronomy/blackbody/Image22c.gif
Intensity
Rayleigh-Jeans Law
Observed Spectrum
Ultraviolet
Visible
Infra-red
0
Wavelength
5

Black-Body Radiation Laws (2)

2- Planck Law

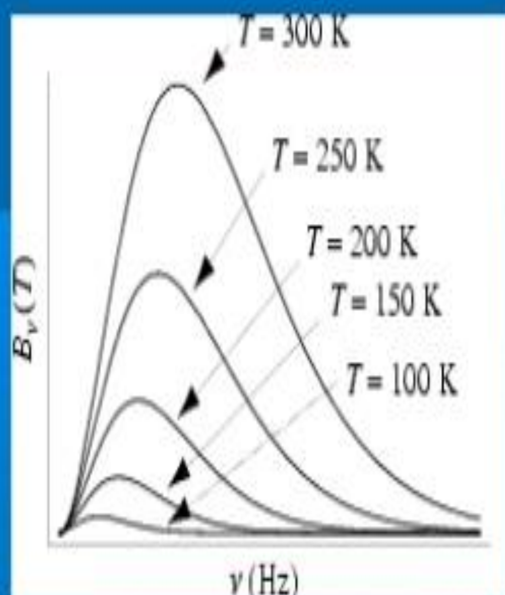
- We have two forms. As a function of wavelength.

$$I(\lambda,T) = \frac{2hc^2}{\lambda^5}\frac{1}{e^{\frac{hc}{\lambda kT}}-1}$$



And as a function of frequency

$$I(\nu,T) = \frac{2h\nu^3}{c^2}\frac{1}{e^{\frac{h\nu}{kT}}-1}$$



The Planck Law gives a distribution that peaks at a certain wavelength, the peak shifts to shorter wavelengths for higher temperatures, and the area under the curve grows rapidly with increasing temperature.

http://scienceworld.wolfram.com/physics/PlanckLaw.html

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STEFAN'S LAW

- For hot objects other than ideal radiators, the law is expressed in the form:

$$\frac{P}{A} = e\sigma T^4$$

- where e is the emissivity of the object (e = 1 for ideal radiator).
- e = characteristic of the surface of the radiating material ($0 < e < 1$)
- black surface such as charcoal, e close to 1, shinny metal surfaces have e close to 0 (emit less radiation and absorb little radiation that falls upon them).
- e depends on the temperature of material.
- Black and very dark object is good emitter and good absorber.
- Example : The light-colored clothing is preferable to dark clothing on a hot day.