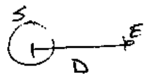
① $w(\lambda, T) = \frac{8\pi hc}{\lambda^5} \frac{1}{e^{hc/\lambda k_B T} - 1}$

maximal density $\frac{dw}{d\lambda} = 0$ $\left(\frac{d^2 w}{d\lambda^2} \cancel{<} 0 \right)$ $\quad \alpha = \frac{hc}{k_B T} \rightarrow \frac{d}{d\lambda} \left(\frac{1}{\lambda^5} \frac{1}{e^{\alpha/\lambda} - 1} \right) = 0$

$\rightarrow \left(\frac{-5}{\lambda^6} - \frac{1}{\lambda^5} \frac{e^{\alpha/\lambda}}{e^{\alpha/\lambda} - 1} \left(-\frac{\alpha}{\lambda^2} \right) \right) \frac{1}{e^{x/\lambda} - 1} = 0$ $\quad$ def $x = \frac{\alpha}{\lambda}$ $\rightarrow 5 - x = 5e^{-x} \rightarrow x_0 = 4{,}965$

$$\boxed{\lambda_{max} T = \frac{hc}{4{,}965\, k_B} = 2{,}898 \times 10^{-3}\ \mathrm{m\,K}}$$

For $T_{sun} = 6000\mathrm{k}$ $\quad \boxed{\lambda_{max}^{sun} = 483\ \mathrm{nm}}$



② $I = \sigma T^4 = \frac{\text{Power}}{\text{Area}}$

$P_s = 4\pi R_s^2 \sigma T_s^4 \rightarrow I_E = \frac{P_s}{4\pi D}$ $\quad P_E^{ABS} = I_E \cdot \pi R_E^2 = 4\pi R_E^2 \sigma T_E^4 = P_E^{RAD}$ (thermal equil.)

$$\rightarrow \boxed{T_E = T_s \sqrt{\frac{R_s}{2D}} \simeq 289\ \mathrm{k}}$$

③ $h\nu = K + W$ $\quad h\nu = \frac{hc}{\lambda} = 3{,}55\ \mathrm{eV}$ $\quad K = 1{,}60\ \mathrm{eV} \rightarrow \boxed{W = 1{,}95\ \mathrm{eV}}$

④ Energy cons. $\quad K = h\nu - h\nu'$, $E = h\nu$ $\mapsto \frac{K}{E} = 1 - \frac{\nu'}{\nu}$ $\quad$ using $\lambda' - \lambda = \frac{h}{m_e c}(1 - \cos\theta) = \frac{2h}{m_e c} \sin^2\frac{\theta}{2}$

$$\boxed{\frac{K}{E} = \frac{\frac{2h\nu}{mc^2} \sin^2\theta/2}{1 + \frac{2h\nu}{mc^2} \sin^2\theta/2}}$$

⑤ $\lambda' - \lambda = \frac{h}{mc}(1 - \cos 60) = \frac{h}{2mc} = 1{,}23\ 10^{-12}\mathrm{m} \rightarrow \lambda = 2{,}3\ 10^{-12}\mathrm{m} \rightarrow \boxed{E = \frac{hc}{\lambda} = 5{,}4\ 10^5\ \mathrm{eV} = 8{,}6\ 10^{-14}\ \mathrm{J}}$

⑥ Circular orbit $\quad v = \omega r$

quantization rule $\quad l = mvr = n\hbar$ $\mapsto m\omega r^2 = n\hbar$

$$\boxed{E = \frac{mv^2}{2} + \frac{m\omega^2 r^2}{2} = m\omega^2 r^2 = n\omega\hbar}$$

$$\boxed{\nu(n \rightarrow n') = \frac{E_n - E_{n'}}{h} = \frac{\hbar\omega}{h}(n - n') = \frac{\omega}{2\pi}(n - n')}$$

$\Delta n = 1$ $\quad$ classical and quantum freq. are the same.