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Example : Blackbody radiation from a hot star

The surface of a hot star has a temperature of $10,000\text{ K}$
 10^4 K

→ Calculate its peak emission wavelength λ and its luminosity L .

Wien's Law : $\lambda_{\text{max}} = \frac{2.9 \times 10^6}{T} = \frac{2.9 \times 10^6}{10,000}$

nm
(nanometers)

degrees Kelvin

$$= \frac{2.9 \times 10^{62}}{10^4}$$

$$= 290\text{ nm}$$

⇒ $\lambda_{\text{max}} = 290\text{ nm}$ ultraviolet

Stefan-Boltzmann Law :

Luminosity = $L = \sigma T^4$

$\frac{\text{W}}{\text{m}^2}$

$$= (5.67 \times 10^{-8}) (10^4)^4$$

$$= 5.67 \times 10^{-8} \times 10^{16}$$

$$= 5.67 \times 10^8 \text{ W/m}^2$$

⇒ The luminosity is $L = 5.67 \times 10^8 \text{ W/m}^2$