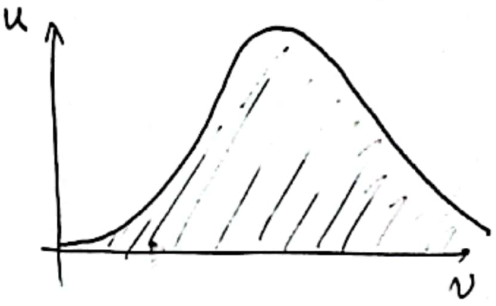
Deriving stephan-Boltzman law using thermodynamics and electromagnetic ?

Stephan-Boltzman law is an imperical equation to describe the total power that radiates from black body.

It predicts:

$$\text{Power} \propto T^4$$

stephan found this relationship in 1879.



stephan law is infact the area under the curve of Black body radiation

later in 1884 Boltzman used the results of Bartoli (who has calculated the radiation pressure from maxwell electrodynamic theory) to ~~calculate~~ derive stephan law from theory!

$$P = \frac{u}{3}$$

$$dU = Tds - pdV \Rightarrow \frac{dU}{dV} = T\left(\frac{ds}{dV}\right) - P$$

$$\xrightarrow[\frac{\partial s}{\partial v} = \frac{\partial P}{\partial T}]{\text{maxwell relation}} \frac{dU}{dV} = T\left(\frac{\partial P}{\partial T}\right) - P$$

$$\xrightarrow[\frac{\partial V}{\partial V} = u]{U = Vu} u = \frac{1}{3}\frac{\partial u}{\partial T} - \frac{u}{3} \Rightarrow \frac{\partial u}{u} = 4\frac{\partial T}{T}$$

$$\Rightarrow \ln(u) = 4\ln T + C \Rightarrow \boxed{u \propto T^4}$$