1. Write down next to these equations what they mean and what they’re used for.

\[ u_{\nu} = \frac{1}{c} \int I_{\nu} d\Omega \]  

(1)

\[ B_{\nu}(T) = \frac{2h\nu^3}{c^2} \left[ \frac{1}{e^{h\nu/kT}} - 1 \right] ; \text{ for } h\nu \ll kT, \quad B(T) \simeq \frac{2kT\nu^2}{c^2} \]  

(2)

\[ B(T) = \frac{\sigma T^4}{\pi} \quad (\sigma = 5.669 \text{ W m}^{-2} \text{K}^{-4} \text{sr}^{-1}) \]  

(3)

\[ \nu_{\text{peak}} \simeq 59 \text{ GHz} \left( \frac{T}{K} \right) \]  

(4)

\[ P_{\nu} = kT \]  

(5)

\[ P = \frac{q^2v^2}{6\pi\epsilon_0c^3} \]  

(6)

\[ |\vec{S}| = \frac{q^2v^2\sin^2 \theta}{16\pi^2\epsilon_0r^2c^3} \]  

(7)

For reference: \( \nu \) is nu; \( v \) is velocity.

2. Some big-picture take-aways from today:

- Blackbody radiation is isotropic; \( \int B(\nu)d\Omega = 4\pi B(\nu) \).
- The fact that noise temperature translates so easily to power for radio astronomy \( (P_{\nu} = kT) \) really only works in the radio regime, under classical mechanics assumptions about the energy behavior of waves.
- Antenna temperature, \( T_A \), can be thought of as the thermal noise of a resistor whose equivalent power output would match that of the observed source.
- Synchrotron and bremsstrahlung emission originate from accelerated point charge emission! Telescope antenna patterns are also based on the Larmor formula.