Stat Mech (PHYS 370) Guide 12

Fall 2024 v2.0

We'll finish out the semester with the blackbody spectrum and a quick tour of phase transitions. Maybe we might have time to the Debye model and/or a return to heat engines.

Reading:
Chapter 7 section 4
Chapter 5 section 3
Review as needed. See your class notes and previous guides a list of covered sections and additional material. Highlight less familiar sections for review and so you can ask questions.

The final exam: The final will be a subset of questions that will be released sometime next week. We'll discuss further options for the timing in class on Tuesday.

Problems: Due before class on Thursday December 12

(1) 7.37 Finding the peak of the Planck spectrum

(2) 7.39 The peak of the Planck spectrum in wavelength

(3) In John Mather's autobiography "The Very First Light" (written with John Boslough) he writes "Planck discovered that if he plotted the intensity versus the product of the wavelength and temperature on a graph, he would always end up with the same shape..." He included this curve:

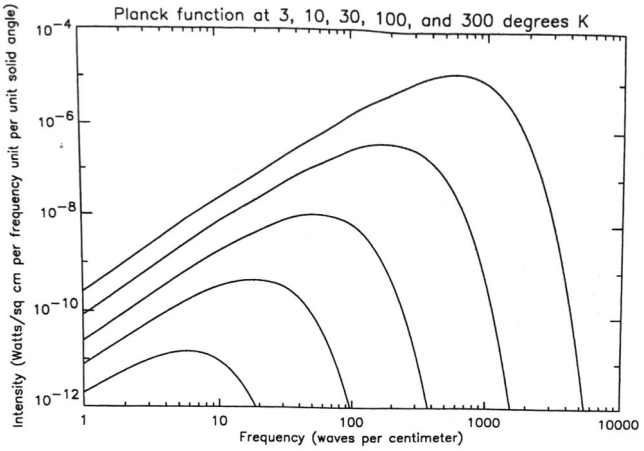

Fig. 1. PLANCK FUNCTION.
This graph depicts blackbody radiation intensity versus frequency. Planck showed that all these curves have the same shape.

This is very different than the plot in figure 7.20. By reproducing this plot show what Planck plotted to achieve this shape invariance.

(4) 7.43 Sunlight. How much of the power do we see? You can use NIntegrate[... , {x, xmin, xmax}] in mathematica to do the integration.

(5) 7.53 More on black holes and Hawking radiation

(6) 5.46 (optional worth 1 pt) On nucleation of water droplets. When you get to part (d) feel free to use $\mu_g - \mu_l = kT \ln(RH)$, where RH is the relative humidity.