Physics CS 36 **Spring 2014**

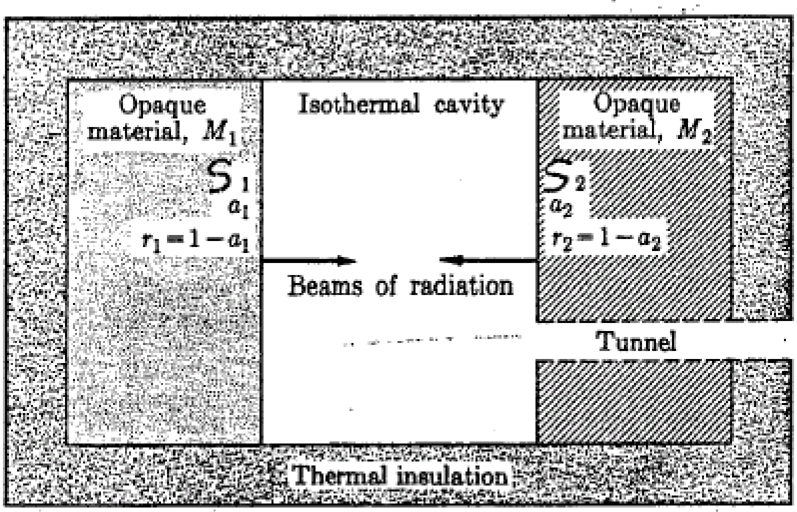
Set #1 - for Thurs April 10

<u>**Read Ohanian**</u> Ch. 3, Sects. 3.1 - 3.4

From Ohanian:

Ch. 3 Problems 3, 4, 6, 7, 11, 13, 14, 16, 24.

1. Consider the radiation traveling back and forth in an isothermal cavity formed between two parallel sheets of different materials, as shown below. Follow the history of the radiation emitted from a unit area of each face during a time interval Δt, which is just long enough to permit the radiation to travel across the space to the other face. The radiation is reflected on the other face with some loss of energy, and so on. While these successive traverses of the <u>initial</u> radiation from <u>each</u> face are occurring, both faces continue to emit. Therefore, when the steady state has been reached, there are simultaneous beams of thermal radiation going back and forth in the space between the two faces. The total radiation streaming in one direction, say to the right, is simply the sum (a sum of an infinite number of terms) of <u>all</u> the components of radiation in that direction. If now a tunnel, which is so narrow that it does not subtract a significant portion of the radiation in the cavity is bored through the right-hand face, show that the leakage radiation will be blackbody radiation.



2. Show that the photoelectric effect cannot occur with a free electron. That is, the electron always needs to be bound to a metal.

3. The radiation from a 500 K blackbody strikes a metal surface whose work function is 0.214 eV. Determine the frequency for which the peak of the blackbody spectrum occurs, and determine the smallest frequency in the spectrum capable of ejecting photoelectrons from the surface. What portion of the blackbody's total emittance S is effective in producing photoelectons from the metal surface? Express the result in terms of a dimensionless integral over the Planck distribution.