

2.4: An aperture as a black body

We consider an enclosure at some temperature and consequently filled with radiation of density u_λ per unit wavelength interval. The inside walls of the enclosure are being irradiated at a rate given by Equation 2.4.1. Now pierce a small hole in the side of the enclosure. Radiation will now pour out of the enclosure at a rate per unit area that is equal to the rate at which the walls are being radiated from within. In other words the exitance of the radiation emanating from the hole is the same as the irradiance within. Now irradiate the hole from outside. The radiation will enter the hole, and very little of it will get out again; the smaller the hole, the more nearly will all of the energy directed at the hole fail to get out again. The hole therefore absorbs like a black body, and therefore, by Kirchhoff's law, it also radiates like a black body. Put another way, a black body will radiate in the same way as will a small hole pierced in the side of an enclosure. Sometimes, indeed, a warm box with a small hole in it is used to emulate blackbody radiation and thus to calibrate the sensitivity of a radio telescope.

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