# 2.6: Net Flux and Exitance

Formerly known as *emittance*, the **exitance** $M$ refers to a point on a reflecting or emitting surface and is defined as the total power emitted in all directions per unit *physical* area, so that

$$M=\int_0^{2\pi}\int_0^{\pi/2}L(\vartheta,\varphi)\sin\vartheta\cos\vartheta d\vartheta d\varphi \tag{2.6.1}$$

where it may be seen from the limits of integration that "in all directions" means over a hemisphere. The factor $\sin\vartheta d\vartheta d\varphi$ is an element of solid angle, $d\omega$, and the factor $\cos\vartheta$ is needed to convert the projected area of radiance back into physical area. Using the notation of Chapter 1., i.e. let $\mu=\cos\vartheta,\ d\mu=-\sin\vartheta d\vartheta$ , we have

$$M=\int_0^{2\pi}\int_0^{1}L(\mu,\ \varphi)\mu d\mu d\varphi. \tag{2.6.2}$$

If we compare $M$ to Chandrasekhar's quantity the *net flux* $\pi F$, which, in particular, he uses for a plane parallel beam of radiation

$$\begin{aligned}\pi F&=\int_0^{2\pi}\int_0^{2\pi}L(\vartheta,\ \varphi)\sin\vartheta\cos\vartheta d\vartheta d\varphi\\&=\int_0^{2\pi}\int_{-1}^{1}L((\mu,\ \varphi)\mu d\mu d\varphi\end{aligned} \tag{2.6.3}$$

we see that the net flux is indeed the result of integration over all directions, *i.e.* over a *sphere*. It follows that net flux and exitance are *not the same thing* (although there may be situations in which they amount to the same), and nor does $\pi F$ always mean the strength of a plane parallel beam of radiant flux density **F**. Indeed, we can calculate the net flux of a plane parallel beam incident on a surface in the direction $(\mu_0,\ \varphi_0)$, using the radiance of a plane parallel beam given by Chapter1, equation (7), as

$$\pi F=\int_0^{2\pi}\int_{-1}^{1}\mathbf{F}\delta\left(\mu-\mu_0\right)\delta\left(\varphi-\varphi_0\right)\mu d\mu d\varphi, \tag{2.6.4}$$

which results in

$$\pi F=\mathbf{F}\mu_{\mathbf{0}}, \tag{2.6.5}$$

this result being the irradiance $E$ of the surface, as we knew it should be!