1.7: Absolute Magnitude

The subject of magnitude scales in astronomy is an extensive one, which is not pursued at length here. It may be useful, however, to see how magnitude is related to flux and intensity. In the standard usage of the word flux, in the sense that we have used it hitherto in this chapter, flux is related to absolute magnitude or to intensity, according to

$$M_2 - M_1 = 2.5 \log(\Phi_1/\Phi_2) \tag{1.7.1}$$

or

$$M_2 - M_1 = 2.5 \log(I_1/I_2) \tag{1.7.2}$$

That is, the difference in magnitudes of two stars is related to the logarithm of the ratio of their radiant fluxes or intensities.

If we elect to define the zero point of the magnitude scale by assigning the magnitude zero to a star of a specified value of its radiant flux in watts or intensity in watts per steradian, equations 1.7.1 and 1.7.2 can be written

$$M = M_0 - 2.5 \log \Phi \tag{1.7.3}$$

or to its intensity by

$$M = M_0{}' - 2.5 \log I \tag{1.7.4}$$

If by Φ and I we are referring to flux and intensity integrated over all wavelengths, the absolute magnitudes in equations 1.7.1 to 1.7.4 are referred to as absolute *bolometric* magnitudes. Practical difficulties dictate that the setting of the zero points of the various magnitude scales are not quite as straightforward as arbitrarily assigning numerical values to the constants M_0 and $M_0{}'$ and I do not pursue the subject further here, other than to point out that M_0 and $M_0{}'$ must be related by

$$M_0{}' = M_0 - 2.5 \log 4\pi = M_0 - 2.748. \tag{1.7.5}$$