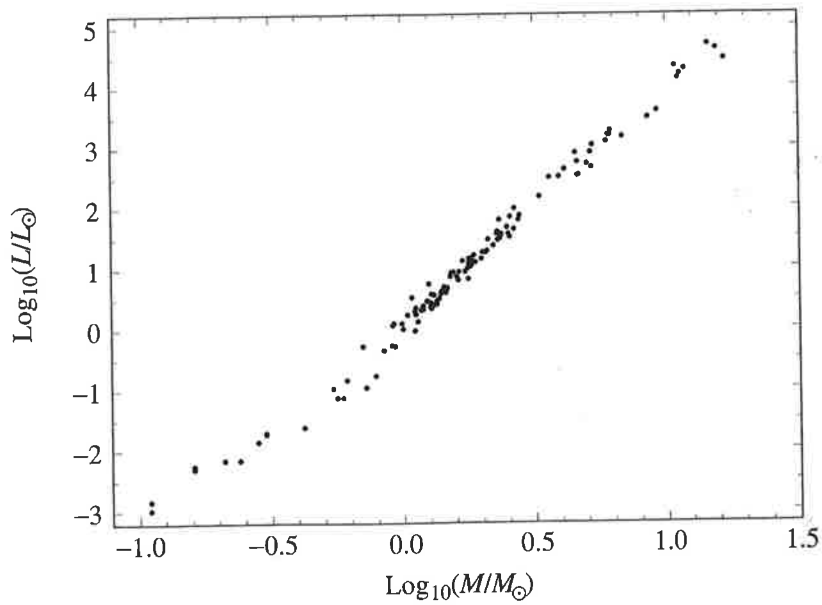

Figure 7.7 The mass–luminosity relation. (Data from Popper, *Annu. Rev. Astron. Astrophys.*, *18*, 115, 1980.)

A good estimate of i is possible in the special situation that a spectroscopic binary star system is observed to be an eclipsing system as well. Unless the distance of separation between the components of the binary is not much larger than the radii of the stars involved, an eclipsing system implies that i must be close to 90°, as suggested in Fig. 7.8. Even if it were assumed that $i = 90°$ while the actual value was closer to 75°, an error of only 10% would result in the calculation of $\sin^3 i$ and in the determination of $m_1 + m_2$.

From the light curves produced by eclipsing binaries, it is possible to improve the estimate of i still further. Figure 7.9 indicates that if the smaller star is completely eclipsed by the larger one, a nearly constant minimum will occur in the measured brightness of the system during the period of occultation. Similarly, even though the larger star will not be fully hidden from view when the smaller companion passes in front of it, a constant amount of area will still be obscured for a time and again a nearly constant, though diminished amount of light will be observed. When one star is not completely eclipsed by its companion (Fig. 7.10), the minima are no longer constant, implying that i must be less than 90°.

Using measurements of the duration of eclipses, it is also possible to find the radii of each member of an eclipsing, spectroscopic binary. Referring to Fig. 7.9, if we assume that $i \simeq 90°$, the amount of time between *first contact* (t_a) and minimum light (t_b), combined with the velocities of the stars, leads directly to the calculation of the radius of the smaller component. For example,