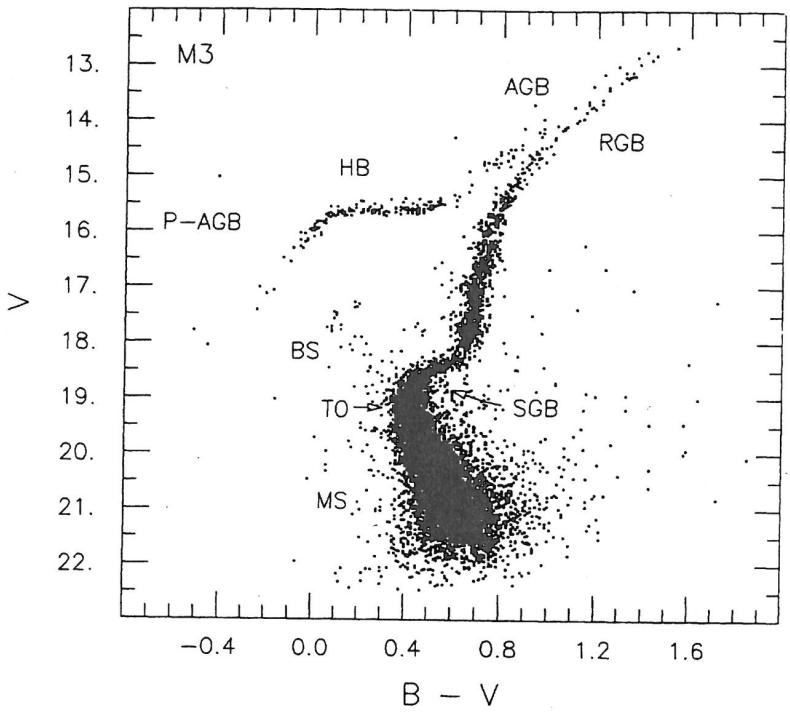

Figure 13.27 A color–magnitude diagram for M3, an old globular cluster. The major phases of stellar evolution are indicated: main sequence (MS); blue stragglers (BS); the main-sequence turn-off point (TO); the subgiant branch of hydrogen shell burning (SGB); the red giant branch along the Hayashi track, prior to helium core burning (RGB); the horizontal branch during helium core burning (HB); the asymptotic giant branch during hydrogen and helium shell burning (AGB); post-AGB evolution proceeding to the white dwarf phase (P-AGB). (Figure from Renzini and Fusi Pecci, *Annu. Rev. Astron. Astrophys.*, *26*, 199, 1988. Reproduced with permission from the *Annual Review of Astronomy and Astrophysics*, Volume 26, ©1988 by Annual Reviews Inc.)

the stars are bright enough to get good spectra), it is much faster to determine their color indices ($B-V$). With knowledge of the apparent magnitude and the color index of each star, a **color–magnitude diagram** can be constructed. Color–magnitude diagrams for M3 (a globular cluster) and h and χ Persei (a *double* galactic cluster) are shown in Figs. 13.27 and 13.28, respectively.

Clusters, and their associated color–magnitude diagrams, offer nearly ideal tests of many aspects of stellar evolution theory. By computing the evolutionary tracks of stars of various masses, all having the same composition as the cluster, it is possible to plot the position of each model on the H–R diagram when the models reach the age of the cluster (the curve connecting these positions is known as an **isochrone**). The relative number of stars at each location on the isochrone depends on the number of stars in each mass range