FIGURE 21.11 Using 21-cm emission to trace out spiral structure. Consider looking out of the Galaxy through three spiral arms (A, B, and C). The outer arms move more slowly than the inner ones. So the velocity difference between us and A is smaller than that between us and C, and the blue shift from A is less than that.

FIGURE 21.12 Actual observations of 21-cm emission at galactic longitude 296.5°, latitude 0.0°. Five distinct clouds appear at velocities of −28, −7, +15, +55, and +114 km/sec. (Data from NRAO.)
Figure 25.16 Water waves and kinematic waves
(a) In a water wave, each molecule rotates about a point on the undisturbed water level in a tiny ellipse. (b) Similarly, a small disturbance in the orbit of a star can cause the star to oscillate in tiny ellipses about its original orbit. The actual path of the star is a precessing ellipse. (Adapted from A. Townes)

Figure 25.17 The origin of spiral density waves in spiral galaxies
(a) Elliptical shape of spiral arms of a spiral galaxy with a perturbation in the orbit of a star. (b) Randomly oriented ellipses representing the orbits of multiple stars in a spiral arm. (c) Randomly oriented ellipses representing the orbits of multiple stars in a spiral arm. (d) Randomly oriented ellipses representing the orbits of multiple stars in a spiral arm. (e) Randomly oriented ellipses representing the orbits of multiple stars in a spiral arm.

18.16 Formation of stars in the wave associated with a density wave.