

10.4 The Dispersion Measure

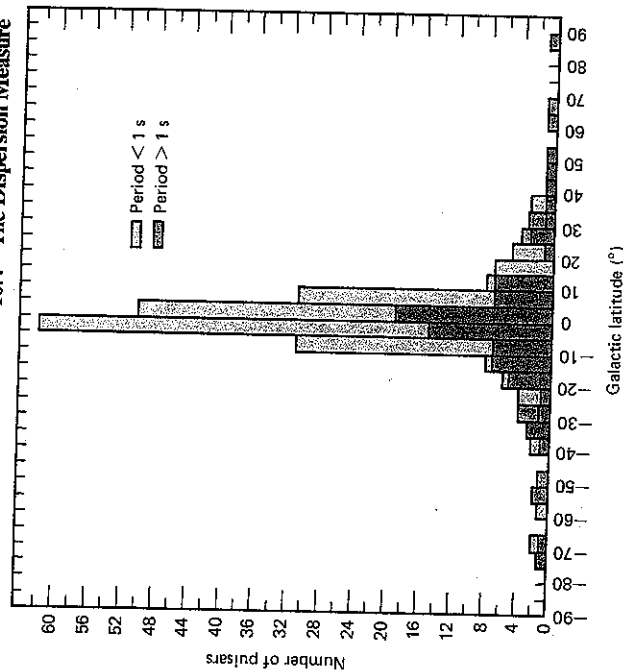


Figure 10.5 Distribution of pulsars in Galactic latitude. Latitude 0° corresponds to the Galactic plane. [Courtesy of Y. Terzian.]

10.4 The Dispersion Measure

Distances to pulsars are inferred from their *dispersion measures*, DM , defined by

$$DM \equiv \int_0^L n_e dl \equiv \langle n_e \rangle L, \quad (10.4.1)$$

where L is the pulsar distance, n_e the electron number density, and l the path length along the line of sight. The dispersion measure is usually quoted in pc cm^{-3} . The name dispersion measure arises because electromagnetic waves are dispersed by the conducting interstellar medium. A broadband pulse arrives later at lower frequencies than at higher frequencies.

Quantitatively, we recall that the acceleration of an electron of charge $-e$ in a tenuous plasma by a propagating electromagnetic wave of frequency ω is given by

$$m\ddot{x} = -eE, \quad (10.4.2)$$

where the electric field may be written as

$$E = E_0 e^{i\omega t}. \quad (10.4.3)$$

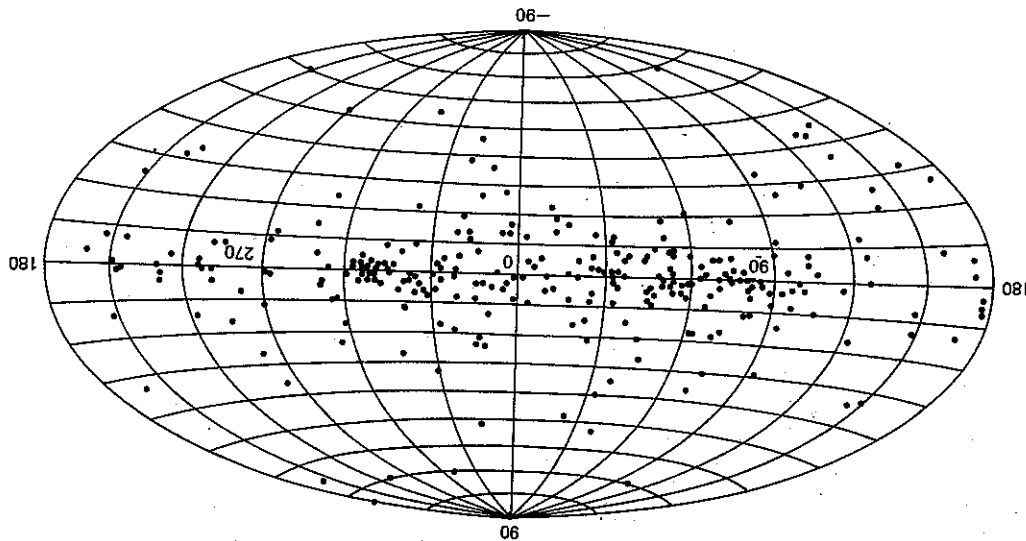


Figure 10.4 Galactic distribution of pulsars. In the adopted coordinates 0° latitude corresponds to the Galactic plane, while 0° longitude, 0° latitude corresponds to the direction of the Galactic center. [Courtesy of Y. Terzian.]