6. OPTICAL POLARIZATION OBSERVATIONS

A. Behr

7. RADIO POLARIZATION OBSERVATIONS; FARADAY ROTATION

J. R. Shakeshaft

Three lines of work are covered: 1. Faraday rotation of the plane of polarized radiation from extra-galactic radio sources, 2. Linearly polarized radiation from the Galaxy, 3. Zeeman splitting of 21-cm absorption lines.

1. It is found that the radiation from extra-galactic radio sources is to some extent linearly polarized at microwave frequencies, a fact which is entirely consistent with the radiation being due to the synchrotron mechanism. In most cases the position angle of the electric vector varies as λ^2, implying that the rotation is due to the Faraday effect. For this:

$$\theta = 0{\cdot}81\, \lambda^2 \int NB_{\parallel}\, dL$$

where θ = angle of rotation (radians)
λ = wavelength (metres)
N = electron density (cm^{-3})
$B_{\parallel}$ = longitudinal component of magnetic field (microgauss)
dL = path length (parsecs).

The quantity θ/λ^2 measures a property of the medium and is termed (1) 'rotation measure' (RM). Sources lying near the galactic plane tend to have large RM's (particularly if $|b| < 10°$), indicating that much of the rotation occurs in our Galaxy (1, 2). A typical RM of 40 rad m^{-2} requires, for example, $L = 10^4$ pc, $B_{\parallel} = 5\ \mu g$ and $N = 10^{-2}\ cm^{-3}$. Morris and Berge (2) have also noted a grouping of sources with RM's of the same sign (Fig. 1) in such a manner that

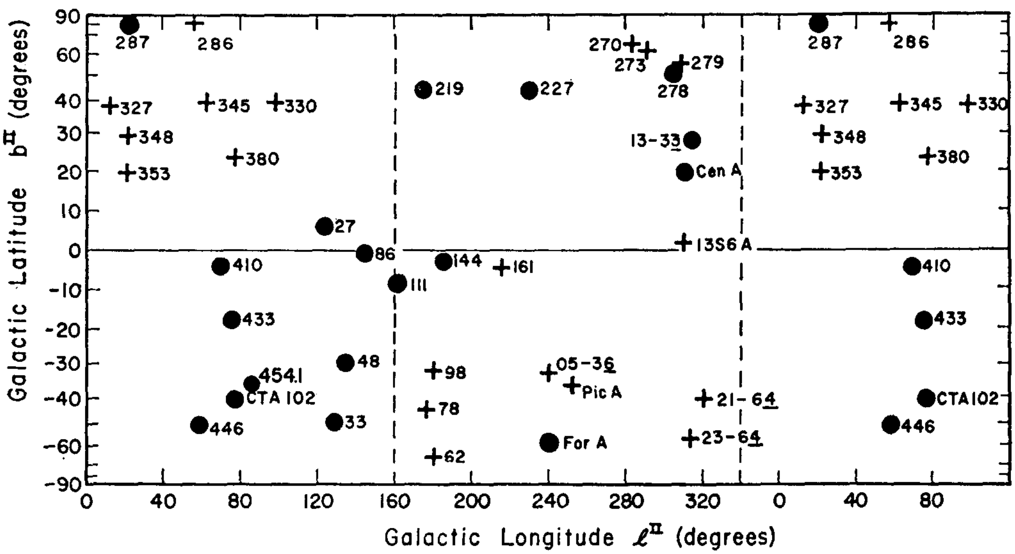

Fig. 1. Variation of the sign of the rotation measure with galactic co-ordinates. Crosses indicate positive RM; dots, negative RM. (Morris and Berge (2)). Positive RM means that the field is towards the observer.