arrive at a model for Sco X-1 described by the following parameters

$$R \sim 10^7 \text{ cm}; B = 5 \times 10^7 \text{ G}; B_{\text{ns}} = 5 \times 10^{10} \text{ G}; \\ \gamma = 5 \times 10^3; N = 6 \times 10^5 \text{ cm}^{-3} \quad (10)$$

This discussion relates only to the emission mechanism and is independent of the assumed energy source. Note, however, that a rotating magnetic dipole^{4,5} can produce $4 \times 10^{35} \text{ erg s}^{-1}$ if the frequency of rotation $\Omega = 10^3 \text{ rad s}^{-1}$ and the magnetic moment $M = 5 \times 10^{28} \text{ G cm}^3$. For this rotation frequency, the acceleration of electrons should occur around $R = c/\Omega \sim 3 \times 10^7 \text{ cm}$, in agreement with the estimate for the size of the emitting region. Pulsed emission, if it occurs, should have a period of about 6 ms.

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Relation between the Linear Polarization and Spectral Index of Quasars

OBSERVATIONS have been made at Jodrell Bank of the linear polarization of ninety-one radio sources at a frequency of 610 MHz ($\lambda 49.1 \text{ cm}$). The sources have flux densities greater than 5 flux units (with the exception of VRO 42.22.01), and have galactic latitudes greater than 10° . In order to discriminate against the (partially polarized) background radiation of the Galaxy, the observations were taken using two radio telescopes—the 250 foot Mark I and the 125 foot Mark II—as an interferometer. The method has already been described^{1,2} and a fuller description of these observations is in preparation. Here we report a striking correlation between the degree of linear polarization at $\lambda 49 \text{ cm}$ and the spectral index of the twenty-three quasars included in the observations.

The median polarization of all ninety-one sources is 1.2 per cent. The value for the twenty-three quasi-stellar sources is 1.5 per cent, and that for the forty-nine radio galaxies is 1.0 per cent. If the quasars are separated

Fig. 1. The degree of polarization at $\lambda 49.1 \text{ cm}$ plotted against radio spectral index at 400 MHz for twenty-three quasars.

according to their spectral index (defined in the sense $\alpha = d(\log S)/d(\log f)$), above and below the median value of $\alpha = -0.5$, a marked divergence can be observed. The median polarization of the twelve "steep spectrum" quasars is 0.4 per cent, while that of the eleven "flat spectrum" quasars is 3.0 per cent. Application of the $(2 \times 2) \chi^2$ test, with divisions at $\alpha = -0.5$, $m = 2.0$ per cent, shows that the probability of such a correlation occurring by chance is less than 0.001. A plot of percentage polarization against spectral index is shown in Fig. 1. In this analysis we have used a spectral index corresponding to the spectral slope at 400 MHz; the values have been taken from Horton, Conway and Daintree³.

Gardner and Whiteoak⁴ find no relation between polarization at $\lambda 11 \text{ cm}$ and spectral index for quasars, showing that the correlation we have found is absent at short wavelengths. We therefore interpret the correlation as follows: quasars can be divided into two sub-classes by spectral index, of which the sub-class with $\alpha < -0.5$ is heavily depolarized at $\lambda 49 \text{ cm}$, probably by the Faraday effect. On the other hand, the polarization of quasars with $\alpha > -0.5$ is more nearly constant and may even increase with wavelength, up to $\lambda 49 \text{ cm}$.

The second sub-class has already attracted attention in having small linear dimensions⁵ and is the class to which the radio variables belong. The spectra of the sources in this sub-class suggest in many cases that they consist of two or more components⁶. Among our flat spectrum quasars are examples both of such multicomponent sources, 3C 279, for example, and of sources the spectra of which appear simple, 3C 286, for example. Our result suggests that whether or not a flat spectrum quasar may be separated into spectral components, there is little Faraday depolarization of radiation from such a source.

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