PROPERTIES OF THE MEDIUM CAUSING ASYMMETRIC DEPOLARIZATION IN STRONG DOUBLE RADIO SOURCES WITH ONE JET

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Polarization data of strong double-lobed radio sources (Garrington et al., 1988a; Laing, 1988) in many cases show that one side is more depolarized than the other. Since a jet is seen only on the less depolarized side it can be concluded that this radio lobe is nearer to us, if the one-sidedness of the jet is interpreted by bulk relativistic motion. The effect is then due to random Faraday rotation where the RMS-rotation angle is larger than about $\pi/2$ for the longer wavelength. This suggests an intervening magnetized plasma which may be the hot gas in the halos of the (elliptical) galaxies or in the cluster. Comparing the effects of both, the intracluster medium (ICM) probably is the dominating component. Garrington (1988b) comes to the same conclusion. Considering the transport of polarized radio waves in a turbulent Faraday screen (cells of size l_0) we further find that the coherence length of the magnetic field is of the order of $l_0 = 1\text{-}4$ kpc. From EINSTEIN X-ray data (for 3C9, 4C01.11, 3C270.1, 3C275.1, 3C208) we find luminosities in the range $L_X = 0.6\text{-}7 \times 10^{45}$ erg s^{-1}, which can only be due to the cluster gas or an active galactic nucleus. If we assume that the total X-ray flux is produced by the ICM the electron core densities are $n_0 = 2\text{-}7 \times 10^{-3}$ cm^{-3}. Combining this with the values for l_0 gives upper limits to the ratio of thermal to magnetic pressure (plasma-beta) of $\beta_p = 50\text{-}370$ and lower limits to the core magnetic field strength of $B_0 = 3\text{-}9\,\mu$G. If the AGN contributes substantially to the X-ray emission the given limits would be even stronger, in the direction of equipartition of energy in the hot gas and in the magnetic field, since B_0 has to be larger if n_0 is smaller to account for the same dispersion in Faraday rotation. We plan to separate the diffuse and the pointlike emission by ROSAT observations. A more detailed version of this paper will be presented elsewhere (Crusius-Wätzel et al., 1989).

References:

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