MULTI-FREQUENCY POLARIZATION STUDIES OF RADIO GALAXIES

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This is a brief report on some of the work in progress at Cambridge, with emphasis on studies of extragalactic radio sources using the One-mile and 5-km telescopes; together with the 6C survey and a new instrument now being commisioned at 151 MHz, we have a frequency range of 100:1 available for high-resolution mapping. The 6C survey has resulted in the discovery of a number of giant radio galaxies, most notably NGC 6251. At 151 MHz, the beautiful jet is not prominent; we have mapped it with the One-mile and 5-km instruments and a paper (by Saunders *et al.*) will shortly appear in *Monthly Notices*. Dr Willis will speak later on the structure of this source.

Many of the galaxies being studied are old favourites - low-luminosity sources (FR class I) like 3C465 and 3C272.1, and 3C66B which is the subject of a joint study with the Leiden group. Using 3C192 as an example of a 'typical' FR class II source (Fig. 1), we see the main features of the emission which have to be explained. In the bridge region, the projected magnetic field is perpendicular to the axis; in the tails (near the hot-spots) it tends to be parallel, and around the hot-spots themselves it is circumferential. If the field were initially tangled, we can understand the field in the hot-spots by using Robert Laing's model of compression into a shell; in the bridge, we need to expand the field transversely.

When we consider the morphology of the sources, we find that many of the bridges are distorted. Those like 3C430 are distorted to one side; plausible explanations include motion relative to the IGM, or a gradient in its density. For bridge like that of 3C192 (or more extreme cases like 3C315), do we need precessing beams or could rotation of gas in the galaxy itself cause the distortion? The hot-spot structure of some sources does suggest precessing beams (for example, 3C20), but others lack the rotational symmetry and might be better explained in terms of shocks in an IGM which has strong density gradients, leading to plausible explanations for the orientations of the hot-spots and their magnetic fields.

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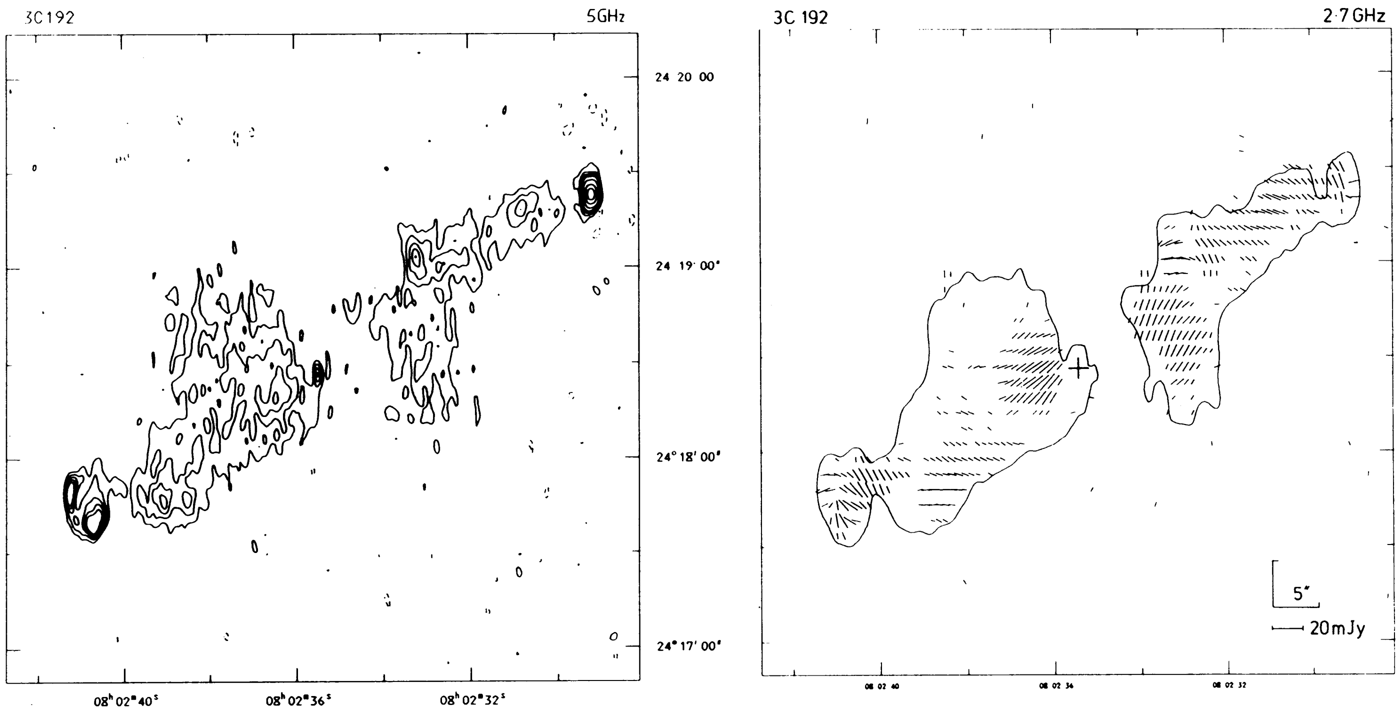

Fig. 1. 3C192, observed with the 5-km telescope.
Left: 5 GHz, resolution 2" x 5"
Right: 2.7 GHz linear polarization (E- vectors). The Faraday rotation is nearly uniform; to obtain the projected magnetic-field direction, rotate the lines counter-clockwise by 70°. Resolution 3".6 x 9".

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