POLARIZATION VARIABILITY OF SOME COMPACT RADIO SOURCES

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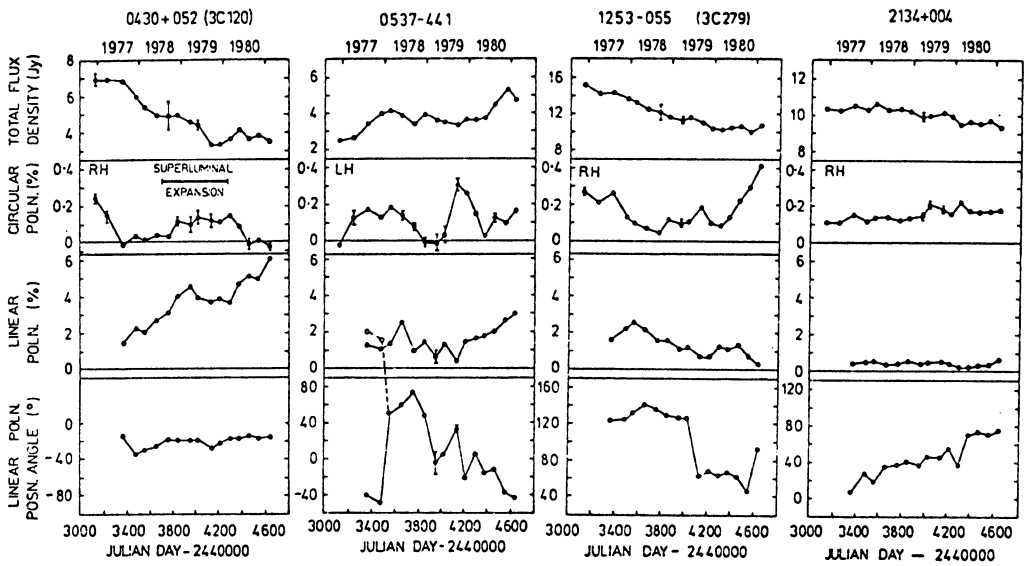

Figure 1. Sample observations from the Parkes 5 GHz programme.

Figure 1 shows observations for four sample sources from the Parkes 5 GHz polarization monitoring programme. Interesting features illustrated include

- Sudden changes of the position angle of the linear polarization by $\gtrsim 70°$ in PKS 0537-441 and 1253-055 (3C279).
- A linear increase in the position angle of the polarization of PKS 2134+004 through 70° over $3\frac{1}{2}$ years.

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- Distinct bursts of circular polarization in PKS 0430+052, 0537-441 and 1253-055. In PKS 0430+052 (3C120) such a burst coincides with the possible superluminal expansion (Walker et al., 1981). In PKS 1253-055 (3C279) a burst of circular polarization is currently occurring at a time of very low linear polarization.

Sudden changes in the direction of linear polarization of up to 90° can result from changes in the relative intensity of two source components having nearly orthogonal directions of polarization. With this process the *degree* of linear polarization (relative to one component) necessarily drops to a very low level at the time of the sudden change of position angle (see Fig. 2, where for simplicity the two

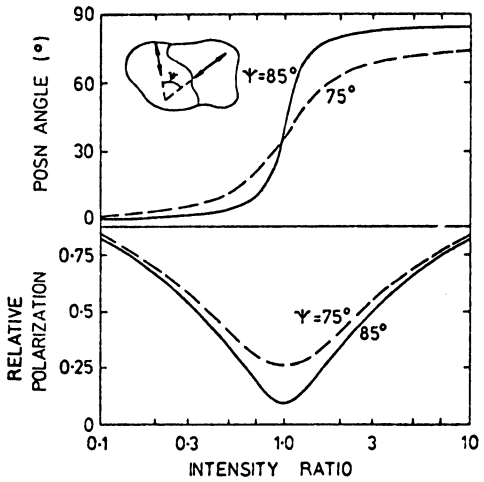

Figure 2. Two-component model.

components are assumed to have the same degree of polarization). In the case of the sudden large changes of position angle in PKS 0537-441 and 1253-055 it is by no means clear that the degree of linear polarization dropped to a low level.

The behaviour of PKS 2134+004 suggests that it may belong to the class of sources, discovered by Ledden and Aller (1979), in which a linear swing in position angle occurs simultaneously at several frequencies (ruling out Faraday effects) and with little change in the degree of linear polarization. Since in one case the position angle rotated through 360° this surely implies a physical rotation of the emitting region or at least a rotary motion of a pattern of excitation, e.g. along a helical magnetic field.

Figure 3 illustrates a class of model in which the direction of polarization is the projection on the sky of the generator of a cone as the generator rotates in azimuth about the axis of the cone. The

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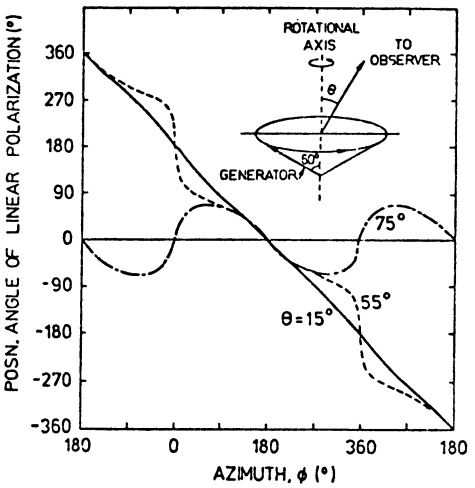

Figure 3. Rotating model.

variation of polarization position angle is shown for a cone semi-angle of 60° and for viewing angles of 15°, 55° and 75° from the rotational axis. The same curves apply to a helix of pitch angle 90°-60° = 30°. Notice that if the swing of position angle is to *exceed* ±90° then the direction of the observer must lie *inside* the cone traced out by the polarization axis. When the direction of viewing lies close to this cone there is a sudden change in the position angle near the time when the polarization axis is most nearly directed at the observer. On some theories a maximum in the degree of circular polarization would be expected at this same time.

References

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Walker, R.C., Seielstad, G.A., Simon, R.S., Unwin, S.C., Cohen, M.H., Pearson, T.J., and Linfield, R.P.: 1981 (personal communication).

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