HIGH OPTICAL POLARIZATION IN FLAT-SPECTRUM RADIO SOURCES

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We have made a polarimetric survey of 84 quasi-stellar objects, to supplement published polarization measurements for two samples of quasars identified with flat-spectrum (core-dominant) radio sources in 5 GHz surveys made at Bonn (Kühr 1980) and at the VLA (Perley 1982). The observations were made using the McDonald 2.1m Struve reflector and the polarimeter described by Breger (1979); the typical accuracy is 0.5% for an 18 mag object after half an hour. Earlier surveys, such as those by Stockman, Moore and Angel (1984), included objects of various radio spectral types, and only a small fraction of the objects showed high polarization (> 3%), but our sample of flat-spectrum quasars reveals many more (about half) of the objects to be highly polarized. Some of them are, expectedly, of the BL Lac class, but many of them have strong broad emission lines. There are two striking correlations among the results:

(1) The degree of polarization is strongly correlated with the dominance of the radio core - specifically, with the ratio, R, of core to lobe luminosity (Fig. 1). For example, about 75% of the objects with log R > 1.25 and redshift z < 1 have p > 3%. This relation implies that if the radio core radiation is beamed, as seems likely, then so is the optical synchrotron component.

(2) The fraction of objects with p > 3% is inversely correlated with redshift (e.g. Fig. 2). The most likely interpretation of this result is that quasars' degree of polarization decreases with decreasing rest wavelength, and the shorter wavelengths are shifted into our wide observational passband at higher redshifts.

The wavelength dependence of polarization that we postulate in order to explain (2) follows naturally from a two-component model for the optical continuum, with a beamed steep-spectrum (synchrotron) component and a flatter one that is unpolarized (the "Big Blue Bump"). We have made detailed measurements of the wavelength dependence of polarization in a few objects, using the Hatfield polarimeter (Bailey and Hough 1982) at the AAO and UKIRT, and the results are a good fit to the predictions of such a model (e.g. Fig. 3). In particular, when the flux spectrum is multiplied by the degree of polarization, measured simultaneously, the polarized component is found to be a steep power law ($\alpha > 1.8$). Similar

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wavelength dependence has recently been reported by others (e.g. Smith et al 1988).

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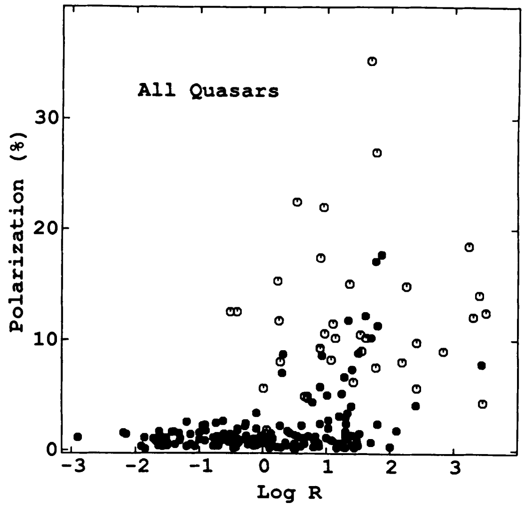

Figure 1 (open circles = BL Lacs)

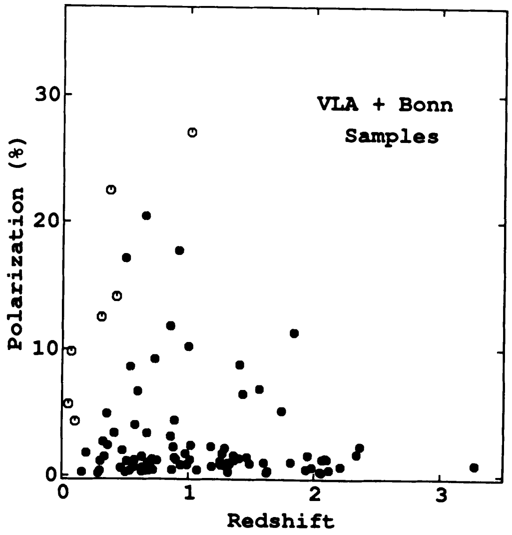

Figure 2

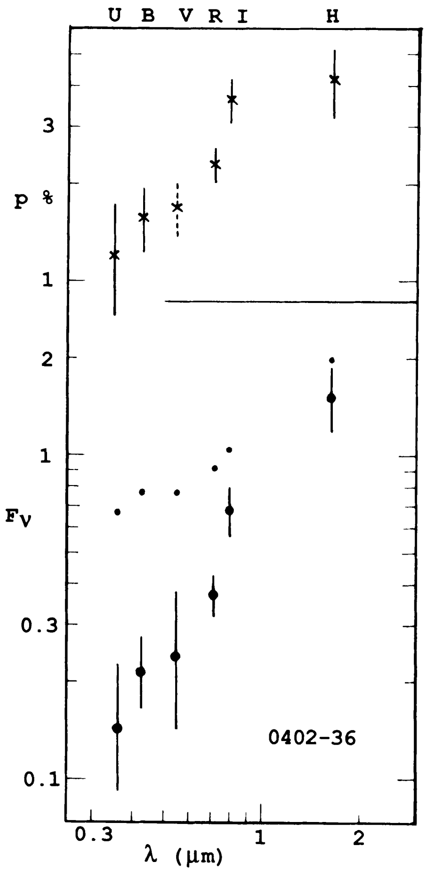

Figure 3. Top: p vs λ for 0402-26 (z = 1.42). Bottom: (dots) flux vs λ, (bars) polarized flux, arbitrarily shifted vertically.

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