OPTICAL SPECTRA AND RADIO PROPERTIES OF QUASARS

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Relations between observed optical and radio properties can, in principle, constrain the geometry and physical conditions of the broad-line regions in quasars and active nuclei. Osterbrock and colleagues (see this symposium) and J.E. Steiner (preprint) have noted differences between Hα/Hβ, [OIII]/Hβ and optical Fe II emission for Seyfert 1 galaxies, broad-line radio galaxies (BLRG's) and quasars. Stockman et al. (1979) discovered a tendency for optical continuum polarization angles for quasars to be aligned with the direction of the outer radio lobes. Setti and Woltjer (1977) and Miley and Miller (1979) noted that the quasars with strongest Fe II are among the most compact radio sources (e.g. 3C 48, 0736+01, 1510-08), and Miley and Miller also note that the distribution of line widths is narrower for the more compact than for extended radio sources.

In Fig. 1, using high quality spectrophotometric scans obtained at McDonald Observatory, and data from the literature I show that, for quasars, the relative strength of optical Fe II emission (the broad blended feature λ4570) may be roughly inversely proportional to line widths (full width at half maximum, FWHM). Fig. 2 shows a similar relation between the relative intensity of the UV Fe II blend between 2300 and 2600 Å (the λ2500 feature) and the widths of Mg II and Hβ. Perhaps half the quasars are common to Figs. 1 and 2, but Fig. 2 extends the relation to higher redshifts. I distinguish between compact and extended radio sources and include radio quiet quasars, Seyfert 1 galaxies and BLRG's. Note that the quasars associated with extended radio sources have the broadest emission lines and the weakest Fe II, falling close to the region occupied by BLRG's which also have extended radio structure. Those quasars with strong Fe II and compact radio structure are most similar to the Seyfert 1 galaxies. The correlation for radio-compact quasars alone is not completely convincing. It may be that the various classes just occupy different regions of the diagram.

My results and those of Osterbrock and others suggest that it may be fruitful to investigate the relationships between the intensity ratios Hα/Hβ and [OIII]/Hβ as functions of line widths and radio structure for

D. S. Heeschen and C. M. Wade (eds.), Extragalactic Radio Sources, 373–374.

https://doi.org/10.1017/S0074180900028205 Published online by Cambridge University Press

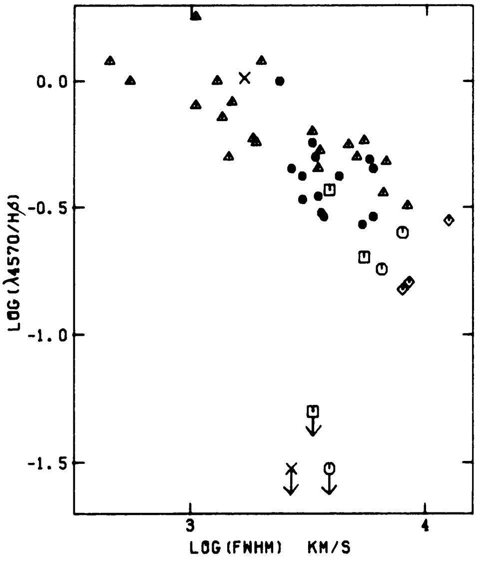

Figure 1. Relative FeII λ4570 intensities as a function of line width. Symbols are as in Figure 2.

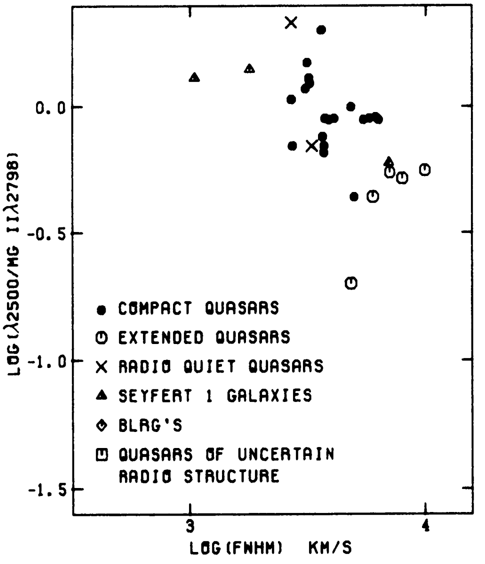

Figure 2. Relative FeII λ2500 intensities as a function of line width, for broad-line objects.

quasars alone and for broad emission line objects as a whole.

Osterbrock (this symposium) has suggested some reasons why optical line strengths and radio structure may be related. It has been suggested at this symposium and elsewhere that compact sources may often be extended double radio sources viewed end-on, and that we could be viewing the energy machine (rotating massive body) from the pole. A picture in which the broad line emitting material tends to be confined to a thick plane (disc) perpendicular to the radio axis would explain 1) the compact radio objects being associated with smaller mass motions (narrower lines) and 2) the greater relative strengths of those emission lines having highest optical depths (e.g., the UV Fe II resonance lines). This model is not without serious objections, but is at least amenable to further, quite simple, observational tests.

I gratefully acknowledge D. Wills' help in obtaining the observations. This research is supported by NSF grant AST 79-01182.

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https://doi.org/10.1017/S0074180900028205 Published online by Cambridge University Press