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Are Radio-Loud Quasars Rebellious or Are Radio-Quiets Just Plain Untalented?[1]

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Abstract. We present some of the results of a preliminary statistical study of 20 QSOs. We compare equivalent widths and widths at 40–80% of flux maximum of the Lyα, Si IV λ1400, C IV λ1549, and C III] λ1909 lines between radio-loud and radio-quiet QSO subsamples and with previously reported findings.

1. Introduction

A small fraction of quasars (QSOs) emit powerful radio emission. Whether this is due to favorable conditions in the radio-loud (RL) QSOs or is due to more fundamental differences in the central engine of RL and radio-quiet (RQ) QSOs is currently unknown.

The UV broad emission lines trace conditions close to the QSO core (on parsec scales) where also the radio emission emerges and thus are important tools to address the questions of possible fundamental differences between RL and RQ QSOs.

2. Sample Selection

The aim of the sample selection is

1. to eliminate redshift and luminosity effects, and

2. to cover the full range of radio spectral indices α and radio core dominances, $R = R_{obs}(5\,\mathrm{GHz}) = S_{core}/S_{total}$.

[1]Observations reported here were obtained in part at the Multiple Mirror Observatory, a joint facility of the Smithsonian Institution and the University of Arizona, and in part at Palomar Observatory, California Institute of Technology.

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Our full sample consists of 110 QSOs, 55 RL and 55 RQ QSOs. The RL QSOs were selected from known radio sources in Barthel et al. (1988) plus the 3C/4C quasar catalogs to meet the criteria (a) redshift $z > 1.5$ and (b) declination $\delta > -30°$ (to be accessible with the Very Large Array). We further distinguish between steep-spectrum (SS) radio sources with $\alpha \geq 0.6$ and flat-spectrum (FS) radio sources with $\alpha < 0.6$, where α is defined by $S_\nu \propto \nu^{-\alpha}$.

The RQ QSOs were selected from Hewitt & Burbidge (1993) to match the RL QSOs on a one-to-one basis in redshift ($\Delta z < 0.010$) and absolute magnitude M_V ($\Delta M_V < 0.3$). The results reported here are based on a subsample of 20 QSOs: 5 FS, 5 SS, and 10 RQ QSOs.

3. Results and Conclusions

Wills & Browne (1986) find an anticorrelation between the Hβ line width and R. Investigating the behavior of the UV line widths reveal C IV likewise to display an avoidance of very broad profiles in core-dominated objects. This anticorrelation of $FWHM$(C IV) with R is significant at the 88% confidence level. $FWHM$(C IV) also correlates with α (with 91% significance); α is related to R.

Wills et al. (1993) found that the C III]/C IV flux ratio correlates strongly with $FWHM$(C III]). This correlation is not significant in our data; the probability of a correlation is just 10%. Our sample may currently be too small (12 points) to confirm this result.

Wills et al. (1993), Brotherton et al. (1994), and Corbin & Francis (1994) all find the C IV and C III] lines to be significantly narrower in RL QSOs than in RQ QSOs. In this subsample, only C III] shows a significant difference (4% K–S test significance) between the RL and RQ QSOs. Indeed, a significant difference is found of the full width measured anywhere between 40–80% of the peak flux. This may be attributed to fainter Al III] λ1858 emission in RL QSOs.

This preliminary study has interesting results which deviate from those of previous studies. Given our improved sample selection, our study is expected to reveal the luminosity-dependent correlations amongst previous results. In this light it is of great interest to investigate the full, statistically significant sample.

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