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Orientation effects in quasar spectra: The broad- and narrow-line regions

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We use the SDSS, along with the NVSS and the WENSS to define a sample of 746 radio-loud quasars and measure their 330MHz to 1.4GHz spectral indexes. Following previous authors we take the spectral index as an indicator of the orientation towards the quasars with more pole-on sources having flatter spectral indexes. We use this proxy for orientation to investigate the effect observing angle may have on optical spectra.

Quasars with flatter spectral indexes tend to be brighter. However, we find no indication of reddening in steep-spectrum objects to indicate obscuration by a torus as a possible explanation. Nor do we find increased redddening in the flat-spectrum sources which could imply a contribution from jet-related emission.

We reproduce a previously-described anti-correlation between the width of the MgII line and radio spectral index indicating a disk-like geometry for the MgII BLR. In contrast to previous authors we find no such correlation for the CIV line suggesting a more isotropic high-ionisation BLR.

Both the [OII] and [OIII] narrow lines have more flux in steep spectrum sources while the [OII]/[OIII] flux ratio is lower in these sources. To describe both of these effects we propose a simple geometric model in which the NLR exists primarily on the surface of optically thick clouds facing the active nucleus and the NLR is stratified such that higher-ionisation lines are found preferentially closer to the nucleus.

Quantitatively we find that orientation may effect the observed strength of narrow lines, as well as ratios between lines, by a factor of ~2. These findings have implications for the use of narrow emission lines to estimate bolometric luminosities, as well as comparisons between narrow line luminosity functions for type 1s and type 2s, and the potential of emission-line diagnostic diagrams as an accurate tool with which to distinguish classes of AGN.

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