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H β Line Widths as an Orientation Indicator for Low-ionization Broad Absorption Line Quasars

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There is evidence from radio-loud quasars to suggest that the distribution of the H β broad emission line (BEL) gas is arranged in a predominantly planar orientation, and this result may well also apply to radio-quiet quasars. This would imply that the observed full width at half maximum (FWHM) of the H β BELs is dependent on the orientation of the line of sight to the gas. If this view is correct then we propose that the FWHM can be used as a surrogate, in large samples, to determine the line of sight to the H β BELs in broad absorption line quasars (BALQSOs).... It is determined that there is a statistically significant excess of narrow line profiles in the SDSS DR7 archival spectra of low ionization broad absorption line quasars (LoBALQSOs), indicating that BAL gas flowing close to the equatorial plane does not commonly occur in these sources. We also find that the data is not well represented by random lines of sight to the BAL gas. Our best fit indicates two classes of LoBALQSOs, the majority ($\approx 2/3$) are polar outflows, that are responsible for the enhanced frequency of narrow line profiles, and the remainder are equatorial outflows. We further motivated the line of sight explanation of the narrow line excess in LoBALQSOs by considering the notion that the skewed distribution of line profiles is driven by an elevated Eddington ratio in BALQSOs. We constructed a variety of control samples comprised of nonLoBALQSOs matched to a de-reddened LoBALQSO sample in redshift, luminosity, black hole mass and Eddington ratio. It is demonstrated that the excess of narrow profiles persists within the LoBALQSO sample relative to each of the control samples with no reduction of the statistical significance. Thus, we eliminate the possibility that the excess narrow lines seen in the LoBALQSOs arise from an enhanced Eddington ratio.

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