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The relationship between BAL QSOs and the general population of AGN

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Abstract. We have compiled a catalog of low redshift Broad Absorption Line (BAL) AGN using relatively broad criteria. The UV absorption line properties have been examined in the context of the Eigenvector 1 (E1) parameter space (probably driven by orientation and Eddington ratio). We consider whether BAL AGN are "every quasar's side-view" or involve sources with the largest Eddington ratio.

"Eigenvector 1" (E1) correlations (Sulentic 2000a) are emerging as a new way to organize type-1 AGN diversity. It is tempting to consider unusual AGN, like Broad Absorption Line (BAL) QSOs in the Eigenvector 1 (E1) context. The E1 parameters which define a fundamental "optical plane" [i.e., FWHM($H\beta_{BC}$) and R_{FeII} = W(FeIIλ4570)/W($H\beta_{BC}$)] can be easily measured and compared to measures for a large database of non-BAL AGN if $z \lesssim 0.8$. Identification of low-z BAL QSO requires space-based observations which limits reliable estimates of their frequency of occurrence. It is consequently difficult to compile a complete sample. At the same time, low-z BAL QSOs have the practical advantage that the Hβ region can be observed from the ground. Another major advantage of low-z sources is that the rest frame can be accurately defined. We identify 6 BAL sources with BALnicity index $\gtrsim$0 km s^{-1} (Weymann et al. 1991; measured on CIVλ1549) within the limits z$\lesssim$0.5 and m$\lesssim$16.0.

The majority of low-z quasars are distributed in an "elbow" sequence within the optical E1 plane (Sulentic et al. 2000a,b). The parameter space occupation is interpreted as being driven primarily by the Eddington ratio ($\propto$ L/M), with orientation (and black hole mass M) acting as sources of scatter (Marziani et al. 2001; Zamanov & Marziani 2002). The six classical BAL AGNs in our sample tend to fall either in the region thought to be occupied by sources with higher inclination, or significantly above the sequence (interestingly, they are the *only* outliers). The FIR spectral energy distributions of the outlying sources (PG 0043+039, Mark 231, IRAS 07598+6508) are markedly different from the other BAL QSOs with a prominent excess relative to the expectations of standard AGN SEDs. The FIR excess points towards a composite origin, with an important Starburst contribution.

FWHM($H\beta_{BC}$) for the outliers is larger than FWHM (FeIIλ4570). IRAS 07598+6508 is the outlier source with the most reliable data at this time. FWHM

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($H\beta_{BC}$) and FWHM(FeIIλ4570) can be meaningfully compared with respective FWHM values of 6000 vs. 2000 km s^{-1}. The $H\beta_{BC}$ profile can be modeled as a line component with a profile similar to FeIIλ4570 plus a blueshifted component which produces additional broadening and which offsets the E1 domain occupation into the outliers region. If only the first component is taken into account, the data point is displaced toward the region representing sources with highest L/M and large inclination. A similar effect is likely to operate for the remaining two outliers. Therefore, outlying BAL QSOs are most likely *extreme Pop. A* sources.

We also analyzed CIVλ1549 and Hβ broad component profiles for BAL QSOs after appropriate FeIIλ4570 subtraction and profile extraction methods (see Marziani et al. 1996). CIVλ1549 is almost completely blueshifted with respect to the rest frame defined by the optical narrow lines. This indicates that the opening angle of the outflow is $\lesssim$90° and that the viewing angle may be <45° from an axis of symmetry.

A correlation between terminal wind velocity v_T (measured as the maximum radial velocity of the absorption thorough) and absolute blue magnitude is suggested even by a small sample which includes 6 mini-BAL within z$\lesssim$0.5 and m$\lesssim$16.0 in addition to the classical BAL QSOs. The relationship between absolute magnitude and v_T suggests that mini and classical BAL AGNs outflow velocities are correlated with the Eddington ratio. Classical BAL QSOs are radiating at a larger L/M value as expected from their position in the optical E1 plane. A more refined treatment which takes the force-multiplier dependence on ionization parameter into account and which compares L/M expectations from v_T and radiation pressure driven winds is in progress.

Our interpretation of the E1 optical plane suggests that radio-quiet BAL QSOs are objects radiating at large Eddington ratio and viewed at an angle far from pole-on (with respect to the accretion disk axis) although within 45°. This condition seems, at least in some systems (and perhaps in all) coeval with heavy obscuration and with a surrounding starburst. An interesting possibility to explain the intrinsic rarity of BAL QSOs at low luminosity may involve a narrowing of the outflow solid angle in the case of heavy obscuration by a surrounding starburst.

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