

COMPARING $H\beta$ AND $MgII$ 2798 AS VIRIAL ESTIMATORS OF BLACK HOLE MASS IN QUASARS

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The broad $MgII2798$ and $H\beta$ lines are the most reliable virial estimators of black hole mass in quasars. Which is more reliable? Part of the challenge centers on comparing $MgII$ and $H\beta$ line profiles in order to improve the $\pm 1-2$ dex M_{BH} uncertainties inherent in single-epoch FWHM measures from noisy spectra. Comparison of $MgII$ and $H\beta$ FWHM measures in the same sources provide an ideal way to compare the two lines. We identified 680 bright SDSS DR8 quasars with spectra showing both $MgII$ and $H\beta$ ($z=0.4-0.75$). The S/N of these spectra are high enough to allow binning in the 4D Eigenvector 1 optical plane. High S/N median composite spectra were computed for 8 distinct bins. Resultant composite spectra yield essentially rms FWHM measures in a restricted range of quasar luminosity (median $\log L \sim 46.2 \pm 0.2$). We confirm that FWHM $MgII$ shows a profile $\sim 20\%$ narrower than $H\beta$. $MgII$ apparently arises at a larger distance from the ionizing continuum. Further refinement requires distinction between sources with narrower Population A and broader Population B profiles. Population A sources show both $H\beta$ and $MgII$ profiles best-fit with Lorentz functions. FWHM $MgII$ measures based on Gaussian profile fits will yield $\log M_{BH}$ estimates 0.1-0.2 dex too high. Spectral type A1 and A2 conform to the general trend of narrower FWHM $MgII$ while extreme Pop. A bins show an increasing ratio $FWHM(MgII)/FWHM(H\beta)$ along with a significant $MgII$ profile blueshift which is likely the signature of a radiation-driven wind. FWHM measures for Population B sources are less certain because they show more complex profiles involving at least two broad-line components involving an nearly unshifted broad (BC) and redshifted very-broad (VBC) components. Only the BC is likely to be a valid virial estimator. If $H\beta$ and $MgII$ are not corrected for the VBC then M_{BH} values for Pop. B sources will be systematically overestimated by $\log M_{BH} \sim 0.3 - 0.4$. We suggest a simple correction that can be applied to the majority of sources. $MgII$ is the safer virial estimator for Pop. B sources because the centroid shift at half maximum is less than for $H\beta$. In the BC+VBC interpretation this is a consequence of the lower VBC/BC ratio in $MgII$.