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HIGH VELOCITY OUTFLOWS IN QUASARS

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Active Galactic Nuclei (AGN) are believed to be powered by accretion onto a Super-Massive Black Hole (SMBH). In order to have material falling into the SMBH, angular momentum conservation requires a counterpart for this accretion that is fueling the SMBH in the AGN. Outflows might play an essential role in active galactic nuclei. They show common occurance, both in quasars (30%-40% in optically selected quasars) and Seyfert galaxies (approx. 60%), but might be ubiquitous if they subtend a small angular distance in the sky. Moreover, they bring information from the AGN inner regions, which is not accesible through other ways. Although for more than a decade models have included material outflowing from an accretion disk around a SMBH, surprisingly there is no consensus in our understanding of basic properties like the acceleration mechanism(s), launch radii, mass loss rates, terminal velocities, etc. We are involved in a program to derive basic dynamical characteristics for some well-studied individual flows, and, in particular, we are interested in High Velocity (HV) outflows since they will present unique challenges for the above mentioned theoretical models.

Previously some classes of outflows have been studied, such as the broad absorption lines (BALs; FWHM > 3,000 km/s). We have developed the first systematic accounting of outflow lines, taking advantage of Sloan Digital Sky Survey data (SDSS) DR4. We have begun a program to study a nearly unexplored part of AGN parameter space: HV winds with v > 10,000 km/s but small velocity dispersions (narrow absorption lines), previously attributed to unrelated (intervening) gas, but that recent statistical studies confirm to be (approx. 36%) AGN winds. We have analyzed the 1,698 highest signal-to-noise ratio spectra with emission redshifts between $1.8<z<3.5$ to be able to observe blueshifted HV C IV outflows given the SDSS spectral coverage. The C IV candidates were fitted in order to extract quantitative information, such as v, REW and FWHM. Variability studies can confirm whether absorption is unrelated (intervening) or related to the AGN (winds). We are currently collecting data on this matter.

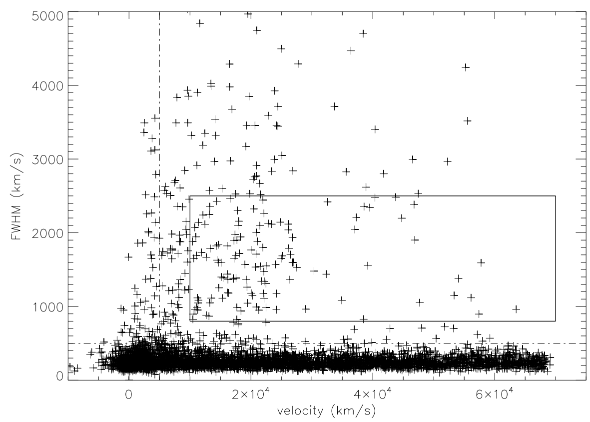

Fig. 1. Velocity-FWHM distribution of the 4437 C IV candidates found and analyzed. Dashed-dotted lines represent selection criteria to avoid intervening systems (FWHM < 500 km/s) and associated systems (v < 10,000km/s). The plot shows continuity in the FWHM-velocity space distribution between narrow absorbers (FWHM < 800 km/s) and broad absorbers (FWHM > 3000 km/s). Our study focuses on the outflows confined by the square (miniBALs with velocities > 10,000 km/s).

* Number of miniBALs found: 195
* Number of quasars with miniBALs: 155
* Number of quasars with HV miniBALs with v > 10,000 km/s: 105
* Number of quasars with HV miniBALs with v > 25,000 km/s: 32

The GTC will allow us to extend this work into the larger context of AGN/SMBH/galaxy evolution, such as examining the relationship of AGN accretion/wind properties to the host galaxy environments.

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