THE INNER STRUCTURE OF ACTIVE GALACTIC NUCLEI FROM SPECTROSCOPY OF LARGE SAMPLES OF QUASARS

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Some galaxies in the Universe show a peculiar activity of non-stellar origin and are for this reason known as *Active Galactic Nuclei* (AGN). AGN characteristics, especially their huge luminosities and unusual spectral features, cannot be explained by the more common stellar processes working in galaxies; the only process able to explain all the "oddities" and features of these structures is the accretion of matter by a central *SuperMassive Black Hole* (SMBH). However, AGN are not only exotic sources with SMBHs. The fact that their number density peaks around $z \sim 2-3$ and evolves with time, along with the discovery of the presence of SMBHs at the center of local, quiescent galaxies, suggests that the AGN activity could be a common phase for all galaxies, making them important also from an evolutionary point of view.

The so called *Unified Model* for AGN (Antonucci 1993) describes the inner regions of these sources through few components (the SMBH and its optically thick accretion disk among them) and asserts that their emission characteristics depend for the most part on the orientation with respect to our line of sight.

The spectroscopical analysis is the only tool available to obtain an insight on AGN: indeed their compactness and distance make spatially resolved observations impossible. Nontheless, the study of the profiles of the lines emitted from different regions allows a comprehension of the geometrical and kinematical properties of these gaseous structures. In particular, the gas of the *Broad Line Region* (BLR), the closest to the central BH, can be assumed as *virialized* (i.e. in gravitational equilibrium as the only force acting on the gas is that exerted by the BH). In such case the Doppler effect implies that the width of a line emitted from the gas, combined with distance, is a measurement of the central mass around which it rotates.

My thesis aims to a better understanding of the physical properties of the inner regions of AGN (in particular of the BLR) through an analysis of the lines emitted in the optical-UV spectral regime. From such a study we can infer information on both the orientation and the kinematics of the regions componing the AGN. By using a suitable orientation indicator (Risaliti et al. 2011) we study very large samples of AGN (such as the SDSS quasar catalogue (Schneider et al. 2010) to find inclination effects on the optical spectral features and to disentangle them from the intrinsic width of the lines. On the other hand, the shape of both the optical (Hβ λ4861Å , among them) and the UV lines (such as CIV λ1549Å) gives indication on the kinematics of the emitting gas; different parts of the line profile (such as the core or the tails, corresponding to different velocities of the emitting gas) come from regions under completely different physical conditions (Denney 2012). In this case a study on individual sources in smaller samples, rather than a more statistical analysis on a large sample, is required. We focus on the comparison of different line properties to understand as much as possible on the physical condition of the structures componing the AGN. In both the cases one of the most important goals is an improvement in the measurement of the SMBH mass (Vestergaard & Peterson 2006).

References

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