Probing the active galactic nuclei (AGN) Torus structure using X-ray spectral variability

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Abstract

It is still a big puzzle as to how the host galaxy gas (at kpc scales) feeds the accretion disk of a supermassive black hole (SMBH), at sub-pc scales, and thereby fuels the central engines of active galactic nuclei (AGN). Circumnuclear structures such as the cold, dusty "torus" are believed to be an active step in SMBH accretion, and understanding the structure of this medium is essential for understanding disk/SMBH fueling. However, the torus structure is still highly debated, with various theoretical models encompassing continuous or clumpy distributions. A major probe of the torus' properties is the variable absorption detected in the 0.3-10 keV X-ray spectra, which serves to probe the torus' morphology and location. Here, we present the latest results from an extensive X-ray spectral variability study of a sample of 20 Compton-thin Seyfert 2 galaxies using XMM, Chandra, Suzaku and NuSTAR. The column density variations (or lack thereof) enable us to probe various torus morphology scenarios and to also consider possible host galaxy contributions to total absorption.
Along the same vein of probing the nature of AGN accretion, we also present results from two additional sample studies: 1. a sample of low luminosity quasars (LLQSOs) in the local Universe, where we find that the accretion properties of these local quasars are similar to those of higher redshift ones, and their lower luminosity scales with having lower black hole masses, and 2. an X-ray study of a sample of local IR-bright galaxies detected with molecular outflows (MOX sample), where we find that both the central AGN as well as starbursts contribute to driving large scale molecular outflows and thereby clearing matter from the central regions of the AGN. These sources have been detected to be extremely X-ray weak, a property also seen in other outflowed AGN such as broad absorption line (BAL) quasars.