The Relation between X-ray and UV Emission in Quasars

As part of the SPIDERS program, a sample of ROSAT X-ray sources have been assigned WISE IR counterparts (Salvato et al., in prep.), and have optical spectra available from the Sloan Digital Sky Survey (Dwelly et al., in prep.). These sources were then matched to GALEX UV counterparts, which resulted in a catalogue of 5500 sources in the redshift range $0 \leq z \leq 2$. This sample is currently being used to investigate the relationship between the UV and X-ray emission in quasars. The possibility of standardising quasar luminosities, such that they can be used as standard candles, will also be investigated.

Source classification and redshift measurements are available from the SDSS optical spectra. In addition, black hole masses and Eddington ratios were estimated by fitting the main broad emission line regions. The continuum is fit by three model components; a power law, a Galaxy template, and an iron emission template. In each case, the broad emission line is fit by up to three Gaussians, along with an additional Gaussian to fit the narrow core. The plots on the right show examples of the model fit to the Hβ region (top) and MgII region (bottom).

**Disk - Corona Interaction:** The correlation between the UV and X-ray luminosity for the ROSAT selected sample of quasars is shown in the left panel below. The slope of this relation is typically found to be less than one, indicating that the relative energy distribution between the UV and X-ray emitting regions is luminosity dependent. The slope of the relation shown below, $0.70 \pm 0.02$, is consistent with that found by Vignali et al. (2003). The relative contribution of the UV accretion disk emission and the X-ray emission from the surrounding corona, is usually characterised by the UV to X-ray spectral index, $\alpha_{OX}$. Using the ROSAT selected sample of quasars, the anti-correlation between $\alpha_{OX}$ and UV luminosity is confirmed, with a slope $-0.119 \pm 0.008$, in agreement with previous work (e.g. Young et al. 2010). This anti-correlation suggests that increasing UV luminosity diminishes coronal emission in quasars.

**Further work:** The UV and X-ray luminosity relation has recently been used to include quasars as standard candles in a Hubble diagram in order to estimate the cosmological parameters $\Omega_M$ and $\Omega_\Lambda$ (Risaliti and Lusso 2015). This sample may also provide a large number of sources which can be added to the Hubble diagram in the redshift range currently populated by type 1a supernovae ($z \leq 1.4$). This will allow the cosmological parameter results obtained from quasars to be compared directly with those obtained from supernovae.

References:

D. Coffey, M. Salvato, A. Merloni, T. Boller, K. Nandra