Highlights of Astronomy, Volume 14
IAU XXVI General Assembly, 14-25 August 2006
Karel A. van der Hucht, ed.

doi:10.1017/S1743921307011805

A VO-based solution to the origin of soft X-ray emission in obscured AGN

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Recent high-resolution imaging observations with *Chandra* have unveiled a striking similarity between the Narrow Line Region (NLR) and the diffuse soft (0.1 - keV) emission-line dominated X-ray morphologies in a number of obscured Active Galactic Nuclei (AGN) on scales as large as 0.1 - 2 kpc (Bianchi *et al.*, 2006, A&A, 448, 499). This discovery suggests a strong link between these components, which points toward a common physical origin. AGN photo-ionization is a natural explanation, consistent with soft X-ray high-resolution spectroscopy (Guainazzi & Bianchi, 2006, submitted). However, the possibility that the bulk of this component is generated by 'local' photo-ionization induced by shocks in the interaction between a radio jet and the interstellar matter, or by mechanical heating in regions of intense star formation cannot be ruled out yet.

In this paper, we discuss a Virtual Observatory (VO) based project, which aims at determining whether this diffused high-energy component can be produced in regions of intense star formation. This approach is based on the comparison between stellar synthesis models and observed Spectral Energy Distributions (SEDs) in a suitable sample of nearby obscured AGN.

The project makes use of the stellar synthesis model SED@ (Cerviño *et al.* 2002, A&A, 392, 19). This is the only stellar synthesis model currently available, which attempts at predicting the X-ray emission in starbursts. In this model it is assumed that the bulk of high-energy photons are produced by gas mechanical heating, i.e., conversion of gas kinetic energy into radiation according to a given efficiency parameter – one of the free parameters in the model) and supernova remnants. SED@ is implemented in a *Theoretical Simple Access Protocol* compatible server, and can, therefore, be accessed by any VO tools able to interpret this protocol. We have applied SED@ to a small (six objects) sample of Compton-thick AGN of the Guainazzi *et al.* (2005, MNRAS, 356, 295) sample. UV to X-rays (EPIC-pn) SEDs were generated from *Simple Spectra Access Protocol* compatible servers through the spectra visualization and analysis tool `VOSpec`, and compared with the SED@ models which best reproduce the observed UV flux density.

In all cases the SED@ predictions lay well below the soft X-ray photometric measurements. In three out of the six cases studied (NGC 1068, NGC 2273, NGC 3393) the starburst contribution is constrained to be $\leqslant 30\,\%$. In NGC 1068 this result is in excellent agreement with the interpretation of high-resolution soft X-rays spectra (Kinkhabwala *et al.*, 2002, ApJ, 575, 732). In the other three cases the constraints are looser, and still a substantial fraction, as high as 70 - 80 % of the X-ray emission, can be attributed to starburst. Nonetheless, the outcomes of the independent research streams outlined above seem all to converge towards the same explanation: the X-ray emitting NLR gas is primarily photoionized by the AGN, although with a strong contribution by resonant scattering (Guainazzi & Bianchi 2006).