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The excitation mechanisms of X-ray oxygen emission-lines

Victoria Reynaldi[1], Matteo Guainazzi[2], Stefano Bianchi[3], Ileana Andruchow[1,4], Federico García[1,5], Iván López[1] and Nicolás Salerno[1]

[1]Facultad de Ciencias Astronómicas y Geofísicas - Universidad Nacional de La Plata
Paseo del Bosque s/n. La Plata, Argentina
email: vreynaldi@fcaglp.unlp.edu.ar

[2]ESA/European Space Technology and Research Centre (ESTEC)
D-SRE, Keplerlaan 1, 2200 AG, Noordwijk, The Netherlands

[3]Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre
via della Vasca Navale 84, I-00146 Roma, Italy

[4]Instituto de Astrofísica de La Plata, Paseo del Bosque s/n. La Plata, Argentina

[5]Kapteyn Astronomical Institute, University of Groningen, The Netherlands

Abstract. We present the Catalogue of High REsolution Spectra of Obscured Sources (CHRESOS) from the *XMM-Newton* Science Archive. It comprises soft X-ray emission-lines from C to Si and the Fe 3C and Fe 3G L-shell transitions. Here, we concentrate on the oxygen emission-lines O VII(f) and O VIII Lyα to shed light onto the physical processes with which their formation can be related to: active galactic nucleus vs. star-forming regions. We are analysing the relationships between the oxygen lines and the luminosities of: [OIII]λ5007, [OIV]25.89μm, MIR-12μm, FIR-60μm, FIR-100μm, and hard X-rays continuum bands.

Keywords. line: formation, plasmas, galaxies: active, galaxies: Seyfert

1. The data and the astrophysical question

The Catalogue of High REsolution Spectra of Obscured Sources (CHRESOS) arises from RGS (Reflection Grating Spectrometer onboard *XMM-Newton*; den Herder *et al.* 2001) data of 62 nearby ($z < 0.07$), Seyfert-type active galactic nuclei (AGNs). The data were obtanined from the *XMM-Newton* Science Archive (XSA). CHRESOS gathers for the first time the soft X-ray emission-line luminosities of H-like and He-like transitions from C to Si, and the Fe 3C and Fe 3G L-shell transitions. We focus our analysis on two important oxygen emission-lines: O VII(f) (0.561 keV) and O VIII Lyα (0.654 keV). We are currently analysing them with multiwavelength (MW) nuclear data: Continuum Fluxes in 14-195 keV, 2-10 keV, Mid-Infrared (MIR)-12μm, Far Infrared (FIR)-60μm, and FIR-100μm continua, and fluxes of two other important oxygen lines: [OIII]λ5007 in the optical, and [OIV]25.89μm in the IR. Since we are probing into the formation mechanism of O VII(f) and O VIII Lyα, the MW data were chosen because of their known relationships with the two scenarios from where these emission-lines can emerge: the AGN and the (nuclear/near nuclear) star-forming regions, or starbursts (SB).

We show some preliminary results in Figure 1. The two diagrams represent the luminosity of O VII(f) and O VIII Lyα against that of [OIII]λ5007 and FIR-100μm, respectively. The former as a proxy of the AGN ionizing power in the Narrow-Line Region (NLR; e.g. Bassani *et al.* 1999; Schmitt *et al.* 2003; Heckman *et al.* 2005; LaMassa *et al.* 2010;

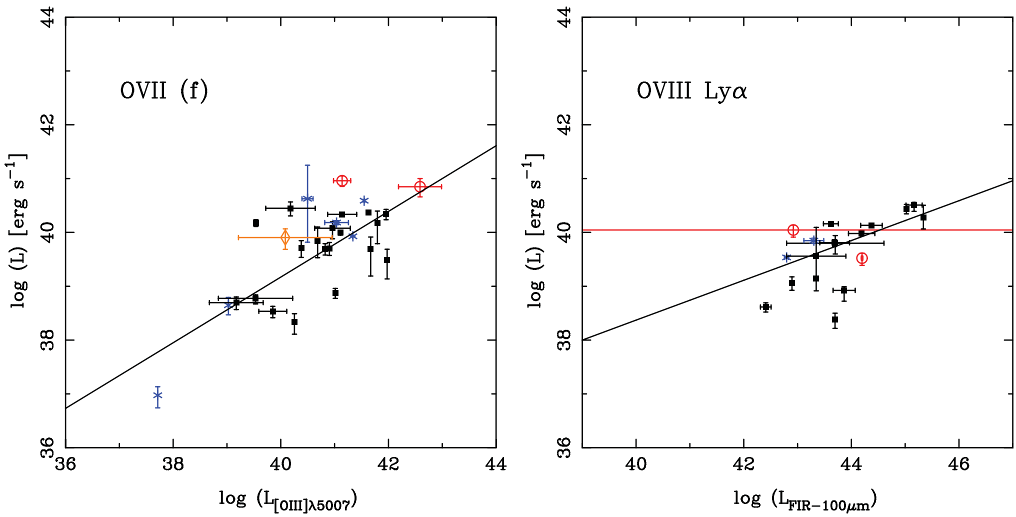

Figure 1. *Left*: diagram of O VII(f) luminosity vs. [OIII]λ5007 (NLR, AGN ionizing power). *Right*: luminosity of O VIII Lyα vs. FIR-100μm continuum (star formation indicator). Seyfert 1-1.2 sources are plotted as empty (red) circles; Seyfert 1.5-1.9 as (blue) asterisks, and Seyfert 2 as filled (black) squares; unclassified sources were drawn as empty (orange) diamonds.

Zhang & Feng 2017), and the the latter as that of star-forming regions (Rodriguez-Espinosa *et al.* 1986, 1987; Mouri & Taniguchi 1992; Hatziminaoglou *et al.* 2010). The sources are described in Fig 1. The continuous line in each diagram represents the best linear fitting (in log space). The data of [OIII]λ5007 were collected from Schmitt *et al.* (2003); Heckman *et al.* (2005) and Panessa *et al.* (2006); and that from FIR-100μm continuum was obtained from Sanders *et al.* (1989, IRAS).

So far, we have found that O VII(f) and O VIII Lyα luminosities are strongly related to [OIII]λ5007, [OIV]25.89μm, MIR-12μm, and the two primary continuum X-ray bands. However, the relationships that point to an origin from the star-forming regions are also meaningful. The two relationships shown in Fig. 1 are statistically significant (90% confidence level) in spite of the small sample size in each diagram (28 and 17 data points, respectively). We continue analysing these relationships and their statistical significance, in order to disentangle the main ionizing mechanisms taking place in the soft X-ray emitting gas.

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