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# OTELO: OPTICAL DATA FOR X-RAY SOURCES IN THE GROTH STRIP

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**We present a preliminary analysis of public, deep (200 ksec.) *Chandra*/ACIS observations of three fields comprising the original Groth-Westphal strip (GWS), gathered from the Chandra Data Archive, combined with optical BVRI data from our broadband survey carried out with the 4.2m WHT at La Palma. This work has been performed in the framework of the multiwavelength study within the OTELO survey (Cepa et al. 2005)**

*Chandra* data were processed using the CIAO software, applying standard reduction procedures. The resulting merged files were filtered to create several energy band events files: Full (0.5–7 keV), Soft (0.5–2 keV), Hard (2–7 keV), Hard2 (2–4.5 keV) and Vhard (4-7 keV). X-ray sources have been detected by applying the CIAO `wavdetect` Mexican-Hat wavelet program to all bands in the three fields. Thresholds have been chosen to limit the number of spurious detections to 1–2 per ACIS chip. Moreover, we have only considered those sources present in the Full band. This filter yields a catalog of 522 X-ray emitters. Median flux is $F_{0.5-7\mathrm{keV}} = 8.53 \times 10^{-15}$ erg cm$^{-2}$ s$^{-1}$, reaching a limit of $F_{0.5-7\mathrm{keV}} \approx 2.2 \times 10^{-16}$ erg cm$^{-2}$ s$^{-1}$. Optical source detection is described elsewhere (Pérez-García et al., this meeting). The X-ray source catalog has been matched against our WHT catalog, using a $2''$ circular box. An optical counterpart is found for about 65% of the sources (we likely miss a population of optically fainter AGNs with $F_{0.5-7\mathrm{keV}} \lesssim 10^{-15}$ erg cm$^{-2}$ s$^{-1}$ and large X-ray to optical flux ratio, X/O $\gtrsim 3$).

We have studied the properties of those sources with optical counterpart. Since photometric redshifts are not available yet, we have limited our analysis to distance-independent parameters. First, we have analysed the set of hardness ratios (colours), defined as

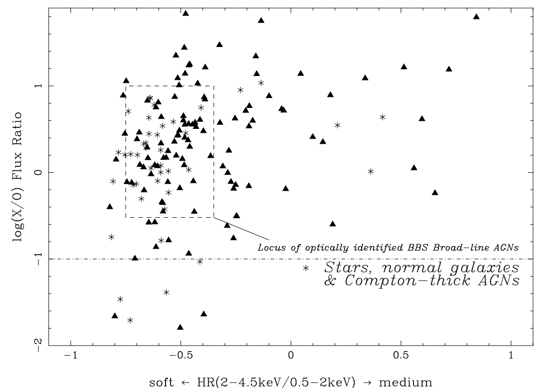


Fig. 1. HR vs. $\log(X/O)$ diagnosis diagram. A set of 119 *Chandra* sources have been depicted (black triangles) along with a comparison set of 43 *XMM–Newton* sources ($*$ symbols) from Sánchez-Portal et al. (2006)

HR = (Counts$_{hard}$-Counts$_{soft}$)/(Counts$_{hard}$+Counts$_{soft}$). We have built colour-colour diagrams, finding that hardness ratios are generally consistent with varyingly absorbed power laws, with photon index raging from $\Gamma$=1 to $\Gamma$=3 and $10^{21}$ cm$^{-2}$ $\leq$ N$_\mathrm{H}$ $\leq$ $10^{23}$ cm$^{-2}$. Second, we have applied HR vs. X/O diagnostics (following Della Ceca 2004), as depicted in Figure 1 finding that 41% (67.5%) of *Chandra* (*XMM–Newton*) sources with unique optical counterpart can be tentative classified as broad-line AGNs (those included in the rectangular region containing 85% of the optically classified broad-line AGNs in Della Ceca 2004). Objects with harder HR can be roughly classified as intermediate/narrow line AGNs. A few objects lie below X/O=0.1, typical of coronal-emitting stars, normal galaxies and Compton-thick AGNs. Finally, we have anlysed the colours of the optical counterparts, finding them consistent with those of early-type and spiral galaxies. Many sources show large optical *V-I* colour compatible with a passively evolving elliptical model (Kodama & Arimoto 1997) for z $\geq$ 0.6.

## REFERENCES

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