The XMM-LSS Survey : about testing the unified scheme upon optically Identified X-ray selected AGN in the [2-10] keV band

O. Garcet[1], P. Gandhi[2], E. Gosset[1] , P.G. Sprimont[1], J. Surdej[1], V. Borkowski[1], M. Tajer[3], F. Pacaud[4], M. Pierre[5], et al.

[1] *Institut d'Astrophysique et de Géophysique, Université de Liège, Belgium*
[2] *RIKEN Cosmic Radiation Lab, 2-1 Hirosawa, Wakoshi, Saitama, 351-0198, Japan*
[3] *INAF-Osservatorio di Brera, via Brera 28, 20121 Milano, Italy*
[4] *Argelander Institut fùr Astronomie, Universitàt Bonn, Germany*
[5] *CEA/DSM/DAPNIA Service d'Astrophysique, Saclay, F-91191 Gif sur Yvette, France*

I. Abstract

We present a sample of 99 spectroscopically identified (R<22 mag) X-ray selected point sources in the XMM-LSS survey with 2-10 keV flux between 8 10^{-15} and 8 10^{-14} erg s^{-1} cm^{-2}. We have performed an X-ray spectral analysis for all these X-ray sources in order to assess whether they are intrinsically absorbed or not. Their optical classification is based on the measured FWHM of the permitted emission lines. The sample turns out to contain 61 broad line AGN, 35 narrow emission line galaxies and 3 absorption line galaxies. We find at most a mild correlation between the X-ray and the optical classifications, with 32 of the 99 X-ray sources having discrepant X-ray and optical classifications. Taking into account the possible dilution of the AGN by their host galaxy and other plausible effects, we have shown that 12% of the X-ray sources are not consistent with the standard orientation-based unified scheme.

II. The samples

- The X-ray sample

$\mathrm{likdet} \geq 20$ [2-10] keV band

80 counts [0.5-10] keV band

32 B and 19 G pointings ~ 6 deg^2

612 X-ray sources

- The optical spectroscopic sample

79 2dF optical spectra (R~600)

9 FORS2 optical spectra (R~1000)

11 VIMOS optical spectra (R~230)

99 spectroscopically identifed X-ray sources

III. X-ray spectral analysis

We have measured the intrinsic N_H by a simultaneous fit of the 3 X-ray spectra (pn, mos 1 and mos 2) with an absorbed powerlaw at zspec.

$$\text{type I} < 10^{22}\ \mathrm{cm}^{-2} < \text{type II}$$

- 79 X-ray sources are unabsorbed in the X-ray (type I)
- 20 X-ray sources are absorbed in the X-ray (type II)

IV. Optical classification criteria

- Type 1 objects (Broad emission lines)

$$V_{FWHM} > 1500\ \mathrm{km\ s^{-1}}$$

- Type 2 objects (Narrow permitted emission lines)

$$V_{FWHM} < 1500\ \mathrm{km\ s^{-1}}$$

V. Optical obscuration versus X-ray absorption

- The Standard, orientation-based AGN unified scheme predicts a one-to-one relation between the optical and the X-ray classifications.
- Up to 32% (32/99) of the AGN in our sample have discrepant optical and X-ray classifications :

	Type I	Type II	N
Type 1	54	7	61
Type 2	25	13	38
N	79	20	**99**

Tab. 1 Number of sources as a function of the optical (type 1 or type 2) and X-ray (Type I or type II) classifications.

Tajer et al. (2007)
Silverman et al. (2005)
Page et al. (2006)

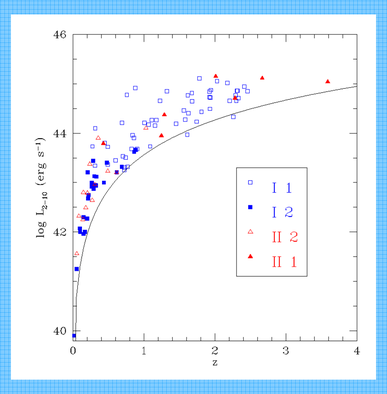


Fig. 1 2-10 keV intrinsic rest-frame luminosity as a function of redshift. The solid line shows the 2-10 keV luminosity as a function of redshift for a 2-10 limiting flux of 8 10^{-15} erg s^{-1} cm^{-2}.

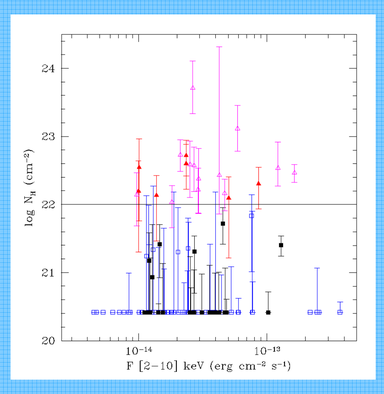
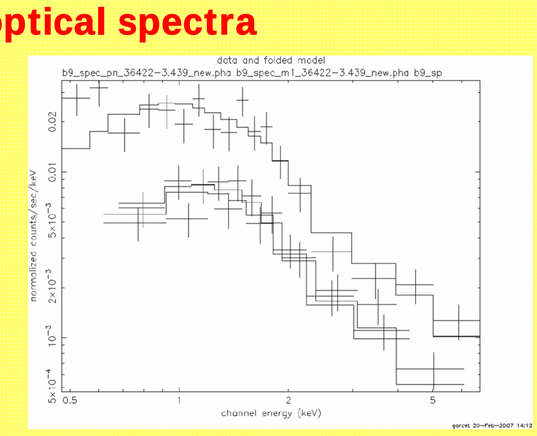
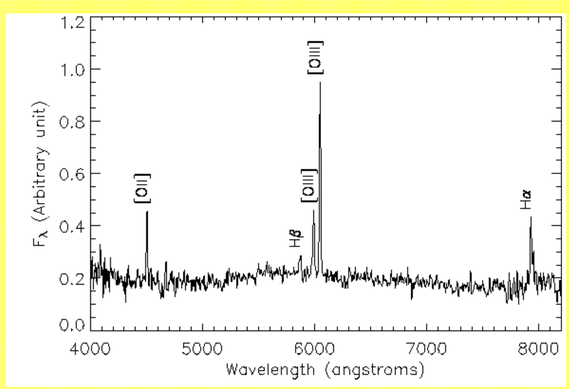


Fig. 2 Column density distribution (galactic+intrinsic component) as a function of the absorbed [2-10] keV flux for the 99 X-ray sources. The symbol convention is the same as shown in figure 1. The error bars correspond to the 95% confidence interval. Data points without error bars correspond to sources for which the column density has been fixed to the galactic value. Their column density are consistent with the galactic value and the presence of absorption in their X-ray spectra is at least rejected at the 95% level. The horizontal line corresponds to the dividing line between type I and type II X-ray sources.

VII. Unabsorbed AGN lacking broad emission lines in their optical spectra

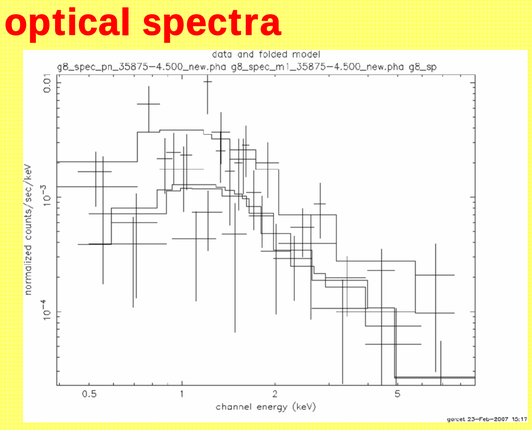


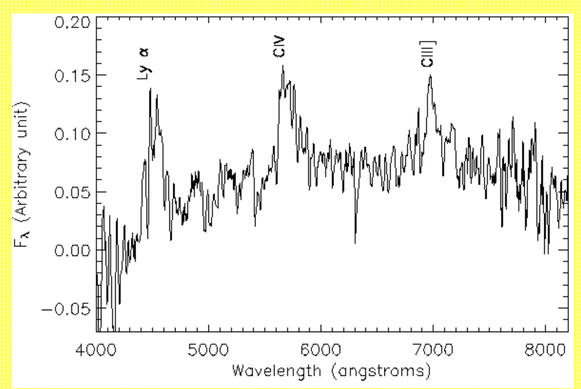


X-ray unabsorbed AGN (N_H ~2 10^{21} cm^{-2}) at z=0.207 with no broad emission lines in the optical.
➡ Discrepant optical and X-ray classifications

Dilution of the AGN emission by the host galaxy light

VIII. Absorbed AGN showing broad emission lines in their optical spectra





X-ray absorbed AGN (N_H ~4 10^{22} cm^{-2}) at z=2.666 with broad emission lines in the optical.
➡ Discrepant optical and X-ray classifications

Large dust grains within the torus imply reduced extinction
Low dust-to-gas ratio imply sublimated dust or ionized gas
➡ wind outflows+ link with BAL QSOs??

IX. Conclusions

We have shown that there is at most a mild correlation between the X-ray and the optical classifications, 32% of the X-ray sources having discrepant X-ray and optical classifications. We have shown that most of this discrepancy comes from the fact that type 2 sources are more likely to be unabsorbed in the X-ray, this trend being mostly due to dilution effects, which do not require any modification of the standard orientation-based unified scheme. We have also found 7 highly luminous AGN, which are absorbed in the X-ray with broad emission lines in the optical, and wich are not consistent with the standard unified scheme. As a conclusion, the standard unified scheme still holds for 88% of the X-ray sources in our sample.

X. References

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Full author list and references wil be provided in the forthcoming paper, Garcet et al. 2007