REFLECTION IN AGN, THE UNIFIED MODEL AND THE CXB

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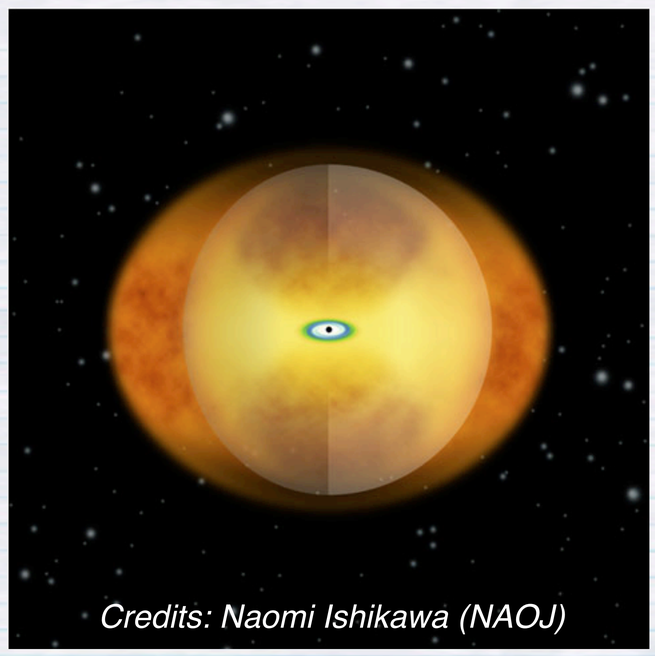
Context

The Unified Model (UM) of AGN ascribes the existence of different classes of AGN to anisotropic obscuration, possibly due to a toroidal absorber. Above 10 keV the effect of the absorbing material decreases, opening a window on the X-ray source. According to the UM, at these energies one would expect the same intrinsic emission for all types of AGN. To test this, we studied the average hard X-ray spectra of different types of Seyfert galaxies (Sy). The knowledge of the average hard X-ray spectra of AGN is also very important for understanding the cosmic X-ray background (CXB).



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The sample

The 200 Seyfert galaxies (Sy) at z<0.2 detected by INTEGRAL IBIS/ISGRI during its first 8 years of operations. Of these we selected those with a detection significance <50σ (17-80 keV). The final sample consists of 45 Sy1s, 31 Sy 1.5s, 68 Sy2s, 10 Compton thick (CT) Sy2s, 12 narrow-line Sy1s.

Results

- ➡ The average spectra of Seyfert 1s and Seyfert 1.5s are consistent ($\Gamma \cong 1.8$, $E_C > 200$ keV).
- ➡ NLS1s are steeper than Seyfert 1s and Seyfert 1.5s above 40 keV, probably due to a lower energy cutoff.
- ➡ Compton-thin Seyfert 2s are significantly harder than Seyfert 1s and Seyfert 1.5s in the 20-60 keV band, showing a "bump", due to a larger reflection component (see Fig.1). Above 60 keV the spectra are consistent.
- ➡ Dividing the Seyfert 2 sample in **mildly** ($10^{23} \leq N_H \leq 10^{24}$ cm^{-2}) and **lightly** ($N_H < 10^{23}$ cm^{-2}) **obscured Sy2s**, we see that most of the enhanced reflection comes from the contribution of mildly obscured objects (see Fig.2).

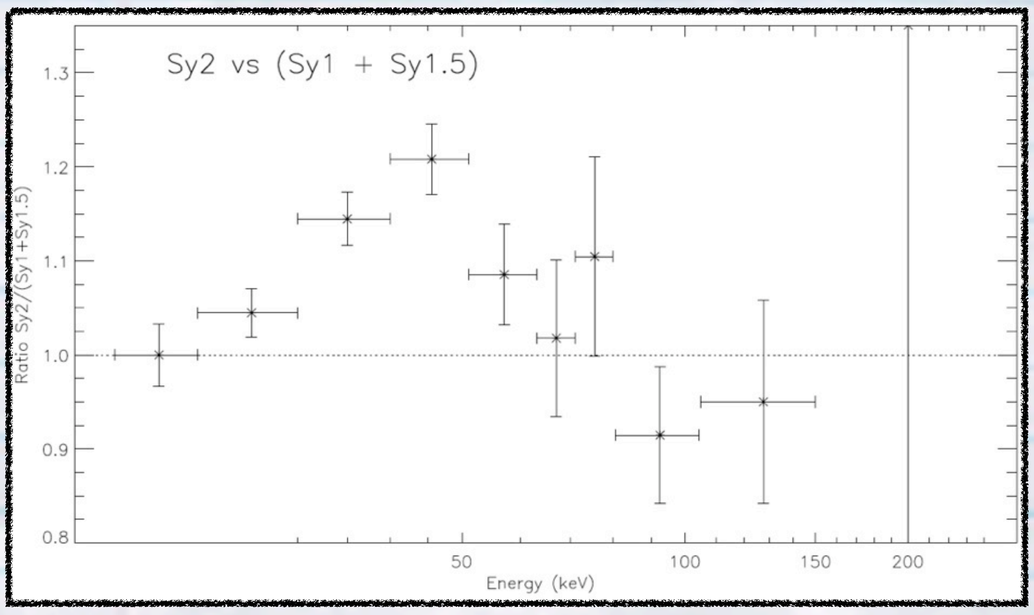

Fig.1 *Ratio between the normalized spectra of Seyfert 2s and Seyfert 1/1.5s.*

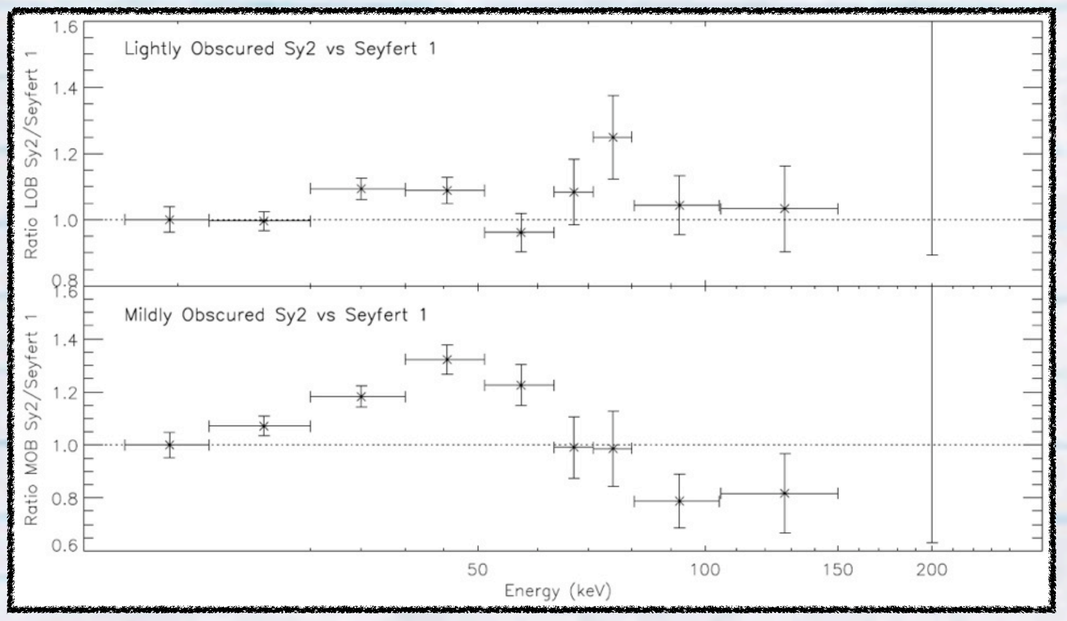

Fig.2 *Ratios between the normalized spectra of lightly and mildly obscured Sy2s, and that of Sy1s.*

Conclusions

- The primary continuum (i.e. the cutoff powerlaw) is the same for the different types of Seyfert galaxies, as predicted by the zero-th order UM. However, a classical toroidal absorber alone cannot explain the large reflection observed in Seyfert 2s
- An absorber covering a large fraction of the X-ray source in more obscured Sy2s might explain our results. Many of our mildly obscured Sy2s might belong to the buried AGN class found by Ueda et al. (2007).
- The large reflection of mildly obscured Sy2s reduces the amount of CT AGN needed to explain the peak of the CXB. Our results are consistent with the fraction of CT being about 10% (see Fig.3).

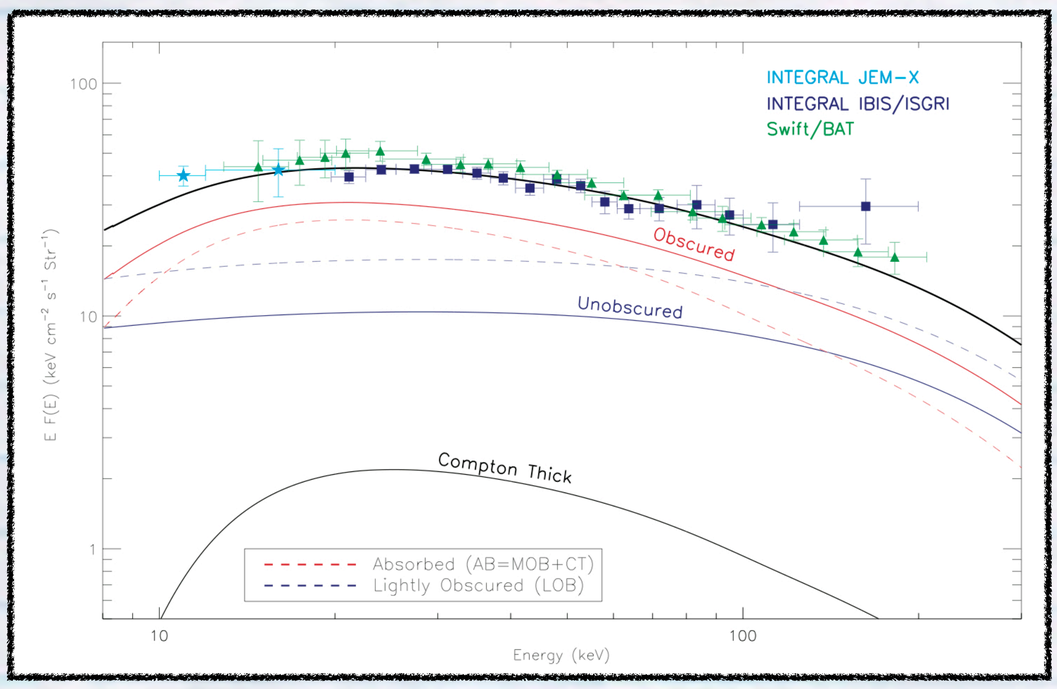

Fig.3 *Fit to the INTEGRAL IBIS/ISGRI spectrum of the CXB (Tuerler et al. 2009). The model used is a combination of our best models for the average spectra of the different classes of objects, normalizing their ratio using the N_H distribution of Treister et al. (2009).*

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