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Understanding the nature of the soft excess in AGN with Simbol-X

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Abstract. The nature of the soft excess and the origin of the spectral shape seen in AGNs are still highly debated. Two different physical models can explain most of the spectral complexities observed in the 0.2–10 keV energy band. One involves a strong reflection component from the innermost parts of an accretion disc, the other a high column density of ionized absorbing material moving at relativistic speed. These two models are degenerate at energies below 10 keV, but predict a distinctively different behaviour at higher energies. It is shown here how, with *Simbol-X*, it will be possible to disentangle the two scenerios observing the spectral shape of AGNs at energies above 10 keV.

Key words. Line: profiles – Telescopes – X-rays: general – X-rays: galaxies

1. Introduction

A common feature in the X-ray spectra of highly accreting type 1 AGNs is a smooth rise of emission (above the extrapolated 2-10 keV continuum) at energies below ∼1 keV, called "soft excess". The spectral shape of the soft excess may be reproduced by a black body component from the accretion disc, nevertheless its temperature is too high to be the high-energy tail of the accretion disc emission. Moreover, the observed constancy, in all PG quasars, of the "temperature" of the soft excess (Gierlinski & Done 2004; Piconcelli et al. 2005; Crummy et al. 2006; Miniutti et al. 2007) disfavours a thermal origin, suggesting an origin tied to atomic absorption/emission processes. Two different interpretations have therefore been proposed recently to fit the soft excess: a relativistic reflection model (model 1 in Fig. 1; e.g. Crummy et al. 2006; Ponti 2006; Ponti 2007) or a relativistically smeared ionized absorption model (model 2 in Fig. 1; e.g. Middleton et al. 2007). These two models are indistinguishable in the 0.2-10 keV band.

Figure 1 shows the relativistic ionized reflection and absorption models fitting the soft excess of Mkn 841, the first AGN where a soft excess has been detected (Arnaud et al. 1985), as observed by XMM-Newton (Petrucci et al. 2006; 2007). As already noted, the two models

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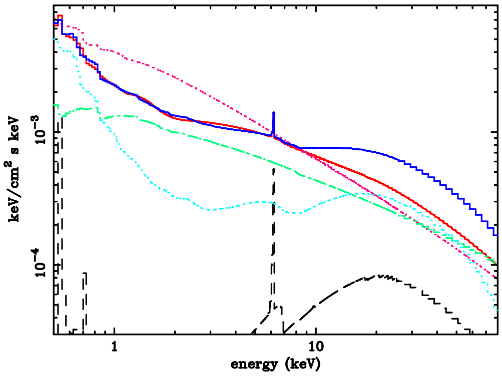

Fig. 1. Model 1: power law component (green dot dashed) plus ionized disc reflection (blue dotted) and the total spectrum (blue solid line). Model 2: intrinsic power law without absorption (red dotted) and power law including the relativistic ionized absorption features (solid red); in addition, MKN 841 has a reflection from distant material (black solid line; Petrucci et al. 2006; 2007).

are indistinguishable in the 0.2-10 keV band, but they predict a flux in the 20-40 keV band that shall differ by at least a factor of 2. This deviation is due to the intrinsic nature of the two models, providing a firm basis for the discrimination among them.

2. The *Simbol-X* capability to disentangle the nature of the soft excess

A 100 ks observation has been simulated using the latest *Simbol-X* response files[1]. Figure 2 shows the simulated data with either the relatistic reflection (black and red) or the relativistic absorption (green and blue) model. The data are indistinguishable in the 0.5-10 keV energy band. Nevertheless, *Simbol-X* will allow us to unambiguously disentangle between the two models because of its high sensitivity in the 10-70 keV band. Although contribution from a neutral reflection component coming from distant material (note the narrow component of the Fe K line in Mkn 841) may complicate the measurement, the *Simbol-X* observation will allow a clear cut result. As shown in

[1] http://www.iasfbo.inaf.it/simbolx/faqs.php

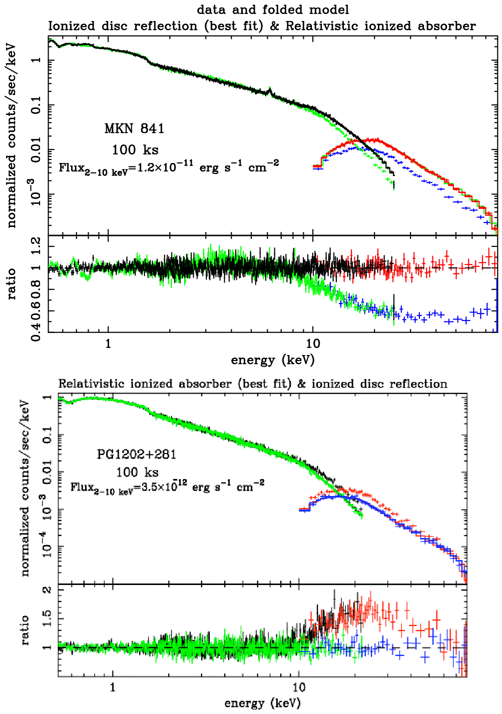

Fig. 2. Model 1 (relativistic reflection) faked data are in black and red and the Model 2 (relativistic absorption) faked data in green and blue.

Fig. 2, the discrimination will be possible also for medium flux sources like PG1202+281 (F_{2-10}=3.5×10^{-12} erg s^{-1} cm^{-2}). These results show that *Simbol-X* is expected to bring new lights on our understanding of the soft excess.

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