X-RAY VARIABILITY IN LINERs

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Context

Active galactic nuclei (AGN) are powered by energetic phenomena which cannot be attributed to stars. AGNs are supposed to be described by the unified model (Antonucci 1993; Urry & Padovani 1995), where a black hole is surrounded by a dusty torus. Depending on the line of sight of the observer, the AGN is classified as type 1when seen face on (direct view of the central engine and the broad line region) or type 2 when seen through the equatorial torus (only the narrow line region is accessible). However, there are several subclasses of objects that cannot be accommodated easily into this unified scheme (Narrow Line Seyfert 1, LINERs etc)

Aims

We are interested in low ionisation narrow emission line regions (LINERs), which seems to be the largest population of AGNs in the local Universe. Sharing many properties with their cousins, Seyferts, they are of much lower luminosities. It has been suggested in different works (Ho 2008, Gonzalez-Martin et al 2009, Maoz 2005) that they are the low power end of the AGN sequence radiating at low Eddington ratios unless they host the most massive black holes (~ 10^9 solar masses). X-ray frequencies are especially well suited method to look for their AGN nature since the inner part of the putative AGN is accessible at these high energies.

Variability across the whole electromagnetic spectrum is one of the main properties of AGN. According to the fundamental plane of AGN (McHardy et al. 2006), the timescale of variations expected in LINERs ranges between few months to years. No variability at shorter timescales has been found (see González-Martín & Vaughan 2012), according to this expectation.

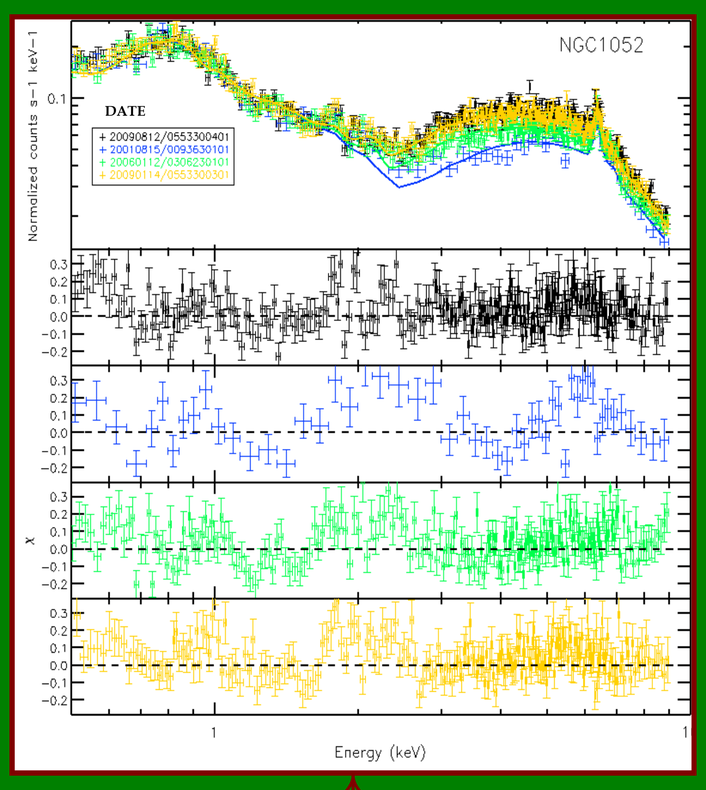
At other wavelength, the first evidence of variability has been reported by Maoz et al. (2005) on a sample of 17 LINERs. They claimed that all but three of them are variable sources in the UV in scales from months to years. Younes et al (2011), based on X-ray observations conclude that the long-term variability is a rather common property of LINERs. However, the reason for such variability is still an open question.

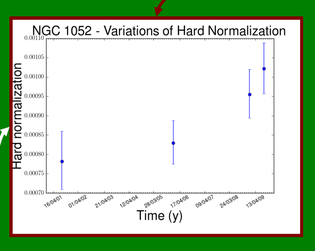
Data & Methods

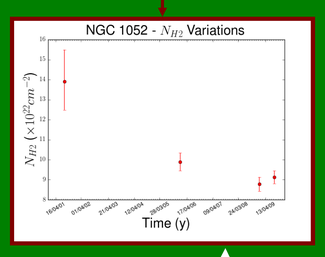
In this work we add more evidence about the X-ray variability in two LINERs. NGC 1052 is a type 1 LINER whereas NGC 4278 is classified as type 2. The data consists on different observations, taken from *XMM*-Newton and *Chandra* archives, of both objects in different epochs with time scale of years. To search for variability we fit all the spectra from the same object with the same model of XSPEC, in order to identify the parameters changing in the period analyzed. This identification will give us clues on the nature of the observed variations.

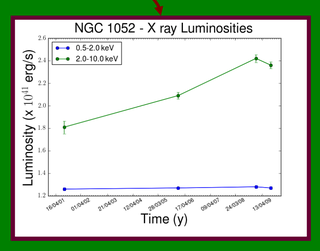
Results

NGC 1052





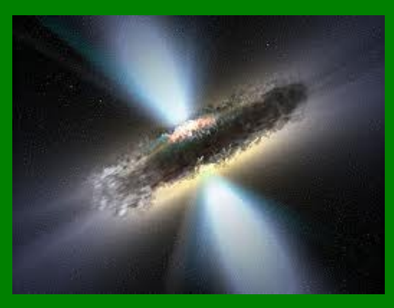




Fitted model: a thermal component plus two power laws with two absorbers.

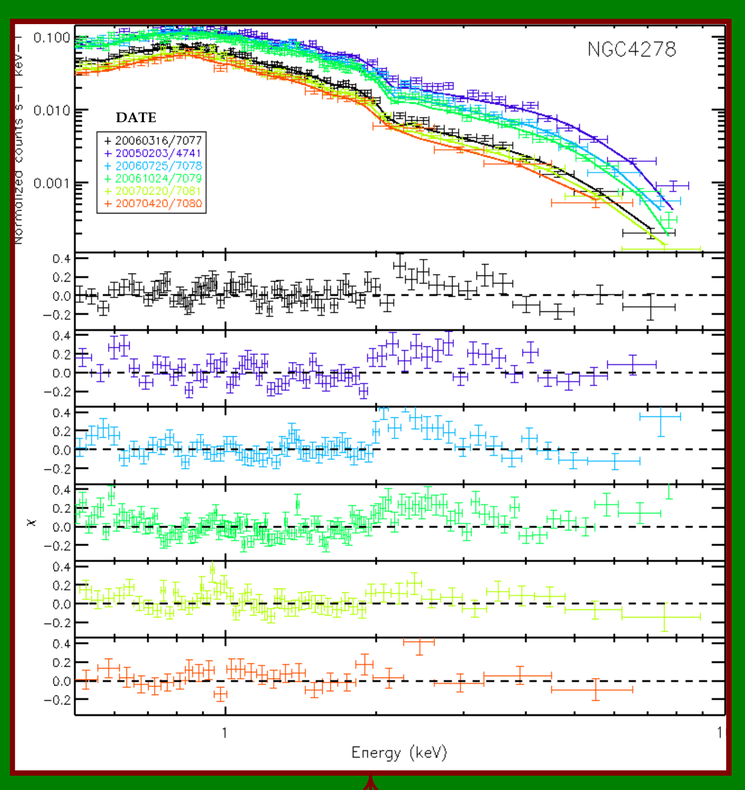
Spectral variability: column density and normalization of the power law (hard energies).

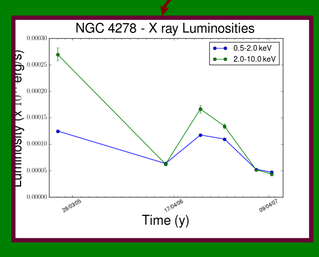
Scenario: consistent with the results given by Risaliti et al. (2007, 2010, 2011) for NGC 1365, UGC 4203 and Mrk 766, where the variability is understood as due to clouds intersecting the line of sight, compatible with the clumpy torus model (Elitzur 2006).

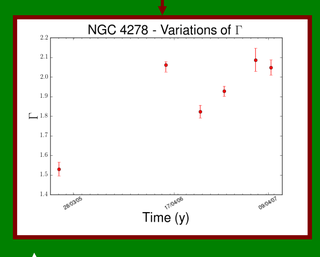


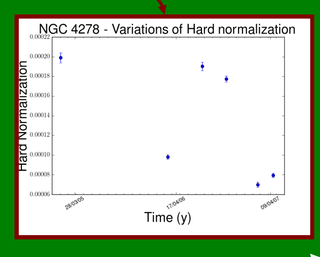
Artists impression of a clumpy torus. Credits: ESO

NGC 4278





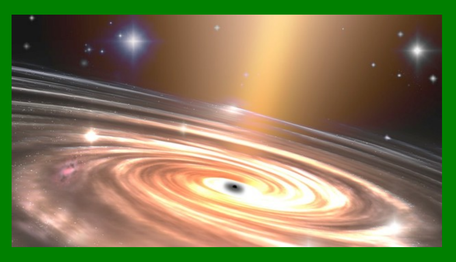




Fitted model: a thermal component plus a single power law.

Spectral variability: slope and normalization of the power law. Consistent with the results provided by Younes et al. (2010).

Scenario: In this case the variability cannot be attributed to the torus but has to be due to an intrinsic variation on the central engine.



Artist impression of an accretion disk. Credits: JILA

Conclusions

We have found different kinds of variability for these objects; while NGC 1052 is supposed to vary due to clouds intersecting our line of sight, NGC 4278 owes its variability to an intrinsic variation on the central engine.
Comparing both results, it is obvious that the X-ray variability is due to different mechanisms in these two objects. Thus a systematic study of variability in these types of galaxies needs to be done. So far, we have identified 14 objects from the X-ray sample of LINERs in González-Martín et al. (2009) which show some hints for variability, based on the X-ray luminosities taken from different authors in the literature.

References:
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