Obscuration Events in nearby AGN

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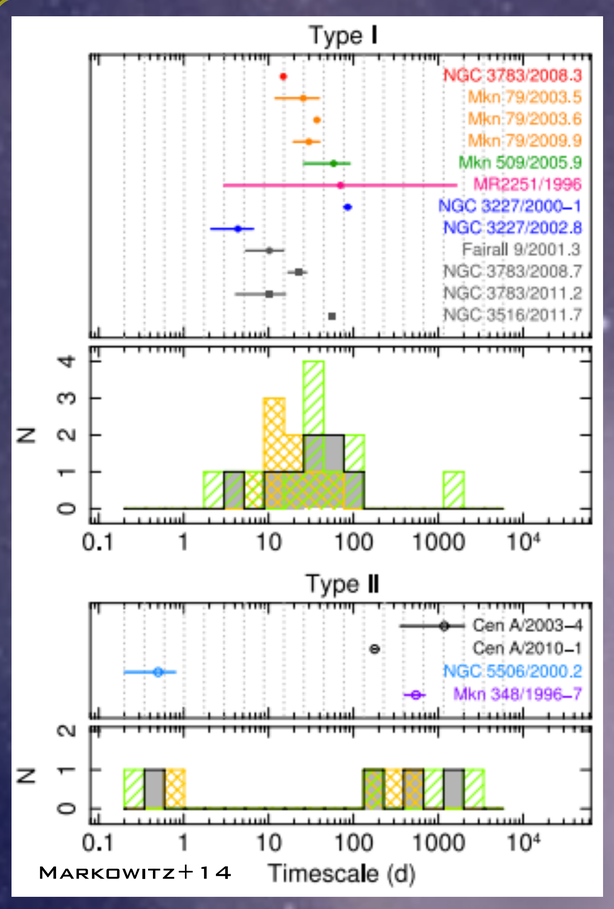


Obscuration events in AGN: A common phenomenon

Transient obscuration events have been recorded for a number of sources so far: Mrk 766 (Risaliti+11), NGC 1365 (Walton+14), Mrk 335 (Longinotti+13), NGC 3783 (Mehdipour+17), ...

Systematic analysis of RXTE fluxes and HR of AGN revealed 12 obscuration events in 8 sources out of a sample of 55 (Markowitz+14).

Limited to obscuring columns $>10^{22}$ cm^{-2} so, if occultations by lower column absorbers are considered, the occurrence of this phenomenon could be even higher.

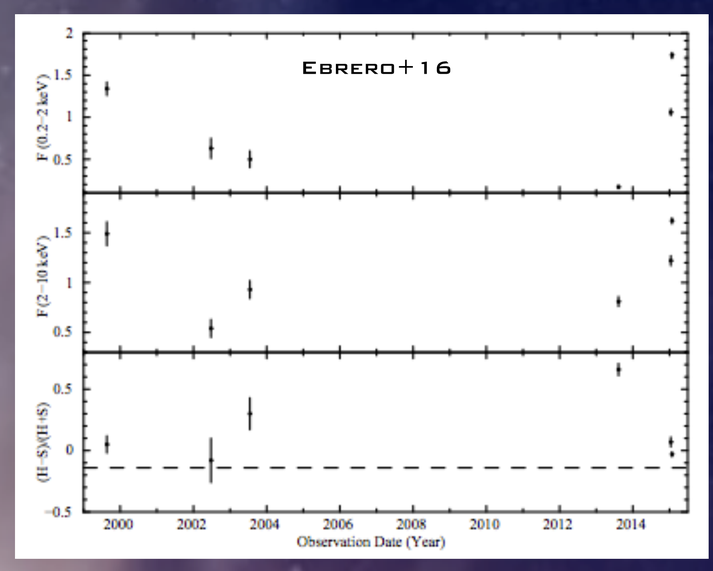
The case of NGC 985

The Seyfert 1 galaxy NGC 985 was caught in 2013 in a low soft X-ray flux state (Parker+14).

New XMM-Newton observations in 2015 showed a substantial increase in the soft X-ray flux.

Historical fluxes show that most of the variability happens in the 0.5-2 keV band, while the 2-10 keV fluxes remain more or less constant.

The derived hardness ratios suggest that the source has undergone a series of obscuration events, the last one happening in 2013 from which NGC 985 has just emerged.



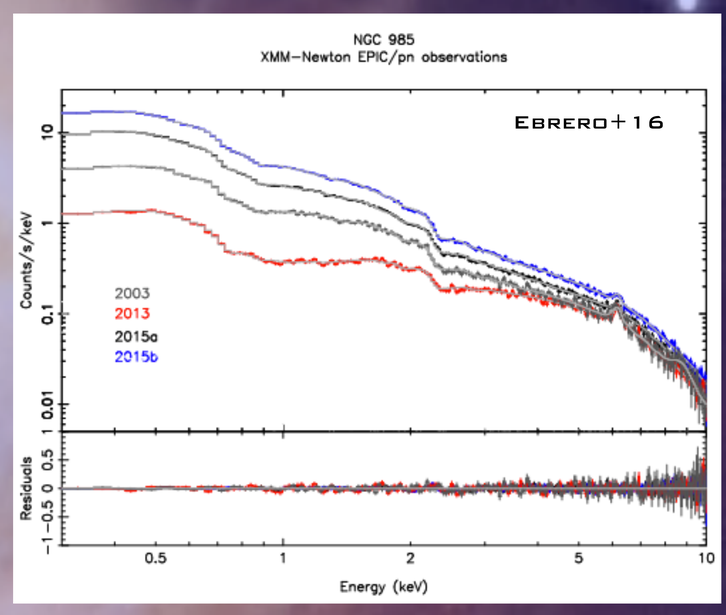
Spectral changes

The XMM-Newton EPIC-pn spectra shows a deficit of soft X-ray photons, while the hard part of the spectra remain similar in all epochs. This suggests that the changes seen can be attributed to obscuration events rather than to intrinsic changes in the source.

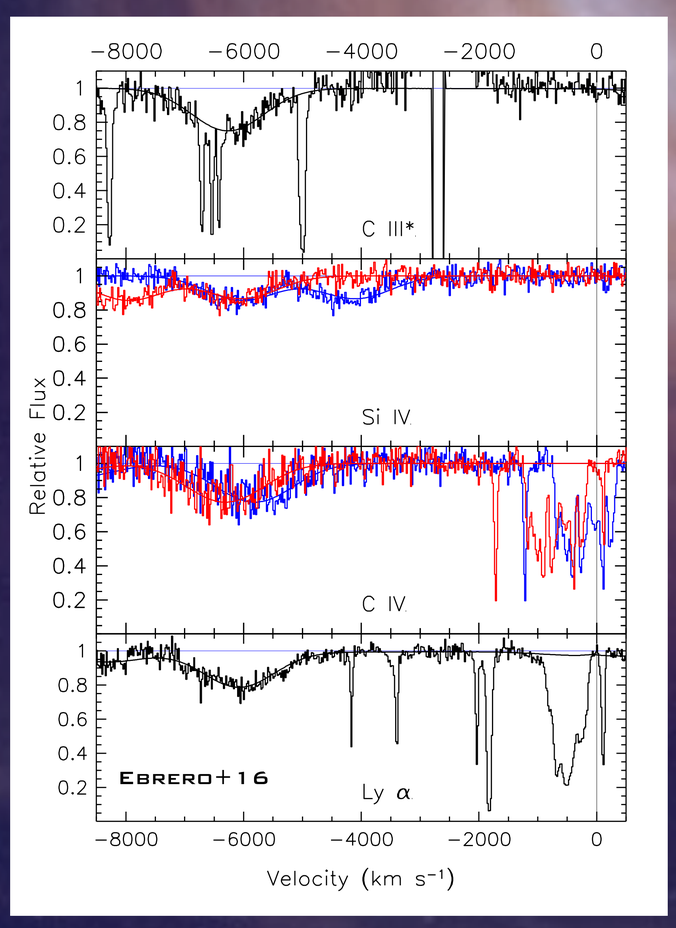
We performed a spectral modeling using SPEX and a photionization balance computed with CLOUDY based on the spectral energy distribution (SED) of NGC 985 in each epoch. The SEDs were constructed using contemporaneous X-ray (XMM-Newton) and UV (HST-COS) data, except for the observation in 2003.

The analysis shows the presence of an intrinsic ionized absorber outflowing in the form of a wind, and a more neutral, thicker obscurer which is causing the observed spectral changes, already reported in parker+14.

This obscuration also happened more than one decade ago, and that the source is emerging now from this obscured state but not entirely. The spectral changes can be explained solely by the variations of the covering fraction of the obscurer, ranging from 85% in 2003, to 92% in 2013, decreasing to less than 20% in 2015 (Ebrero+16).



Characterizing the obscurer in the UV



The obscurer can be tracked down in the UV, where it causes a broad blue-shifted absorption trough in the Ly-alpha region.

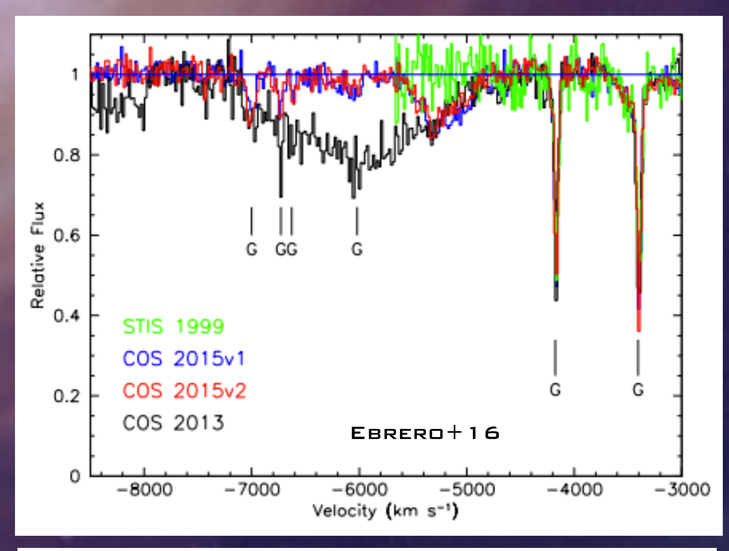
The obscurer is outflowing at ~ 6000 km/s and has an ionization state compatible with the lowest ionisation wind in the X-rays, albeit much faster.

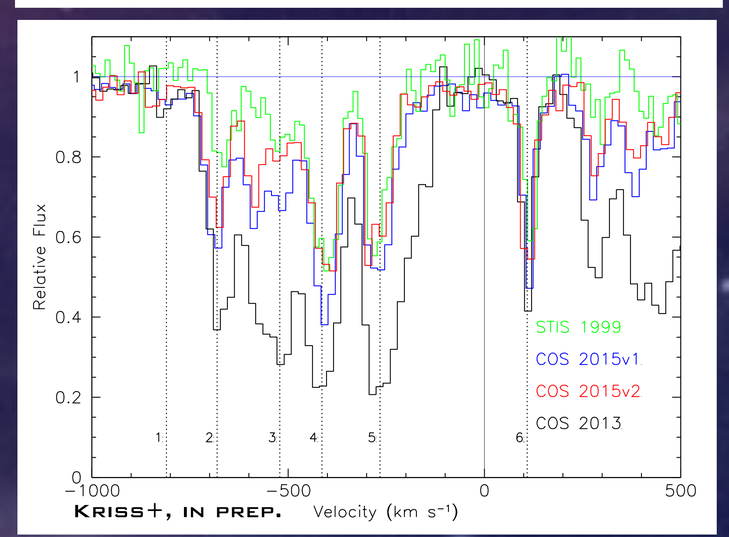
The covering fraction of the obscurer in the UV is lower than in the X-rays (21% in 2013, less than 2% in 2015), owing to the larger size of the UV emitting region.

There are persistent narrow absorption lines in Ly-alpha, N V, and C IV, possibly associated with the low ionisation X-ray gas.

Troughs vary in concert with changes in the continuum flux. These variations can be measured in timescales as short as 12 days.

No signatures of obscuration are seen in 1999. Strong obscuration took place in 2013, which is almost gone (but not entirely!) in 2015. This possibly indicates a recursive event.





Conclusions and Future Work

NGC 985 was caught in 2013 in a very low soft X-ray flux, which was attributed to obscuration by intervening material. Recent observations in 2015 revealed that the source has almost emerged from this obscured state, but not entirely. Analysis of archival observations suggest that this phenomenon might be recurrent and could have happened several times in the last decade. Ongoing work analyzing the RGS spectra in the different epochs shows that some of the ionized components change in response to variations in the ionizing continuum caused by the obscurer, which can be used to set limits on their distance to the central ionising source. This will be reported in a forthcoming paper.

References: Ebrero et al., 2016, A&A, 586, 72; Longinotti et al., 2013, ApJ, 766, 104; Markowitz et al., 2014, MNRAS, 439, 1403; Mehdipour et al., 2017, A&A, 607, 28; Parker et al., 2014, MNRAS, 445, 1047; Risaliti et al., 2011, MNRAS, 410, 1027; Walton et al., 2014, ApJ, 788, 76