Chasing obscuration in type-I AGN: discovery of an eclipsing wind in NGC 3783

Missagh Mehdipour
SRON Netherlands Institute for Space Research

M. Mehdipour, J.S. Kaastra, G.A. Kriss, N. Arav, E. Behar, S. Bianchi, G. Branduardi-Raymont, M. Cappi, E. Costantini, J. Ebrero, L. Di Gesu, S. Kaspi, J. Mao, B. De Marco, G. Matt, S. Paltani, U. Peretz, B.M. Peterson, P.-O. Petrucci, C. Pinto, G. Ponti, F. Ursini, C.P. de Vries, and D.J. Walton

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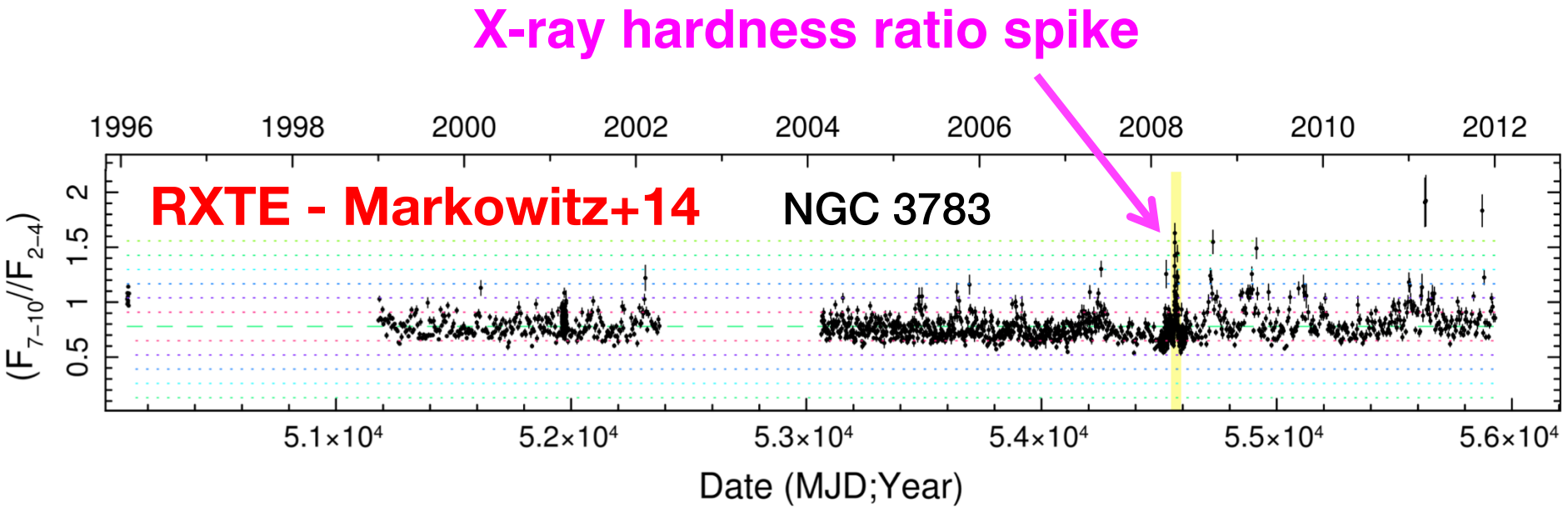
X-ray Universe 2017 - Rome

Transient obscuration in type-I AGN



Markowitz+14 RXTE study ➔ X-ray eclipses in 8 type-I AGN

- ✧ Origin of X-ray hardening events?
- ✧ X-ray eclipses by absorption?
- ✧ Outflowing? Location?
- ✧ Obscuring disk wind (like in NGC 5548, Kaastra+14)?

Catching transient obscuration with Swift

X-ray & UV spectroscopy of an eclipse is needed

Swift monitoring program ➔ ToO observations with:

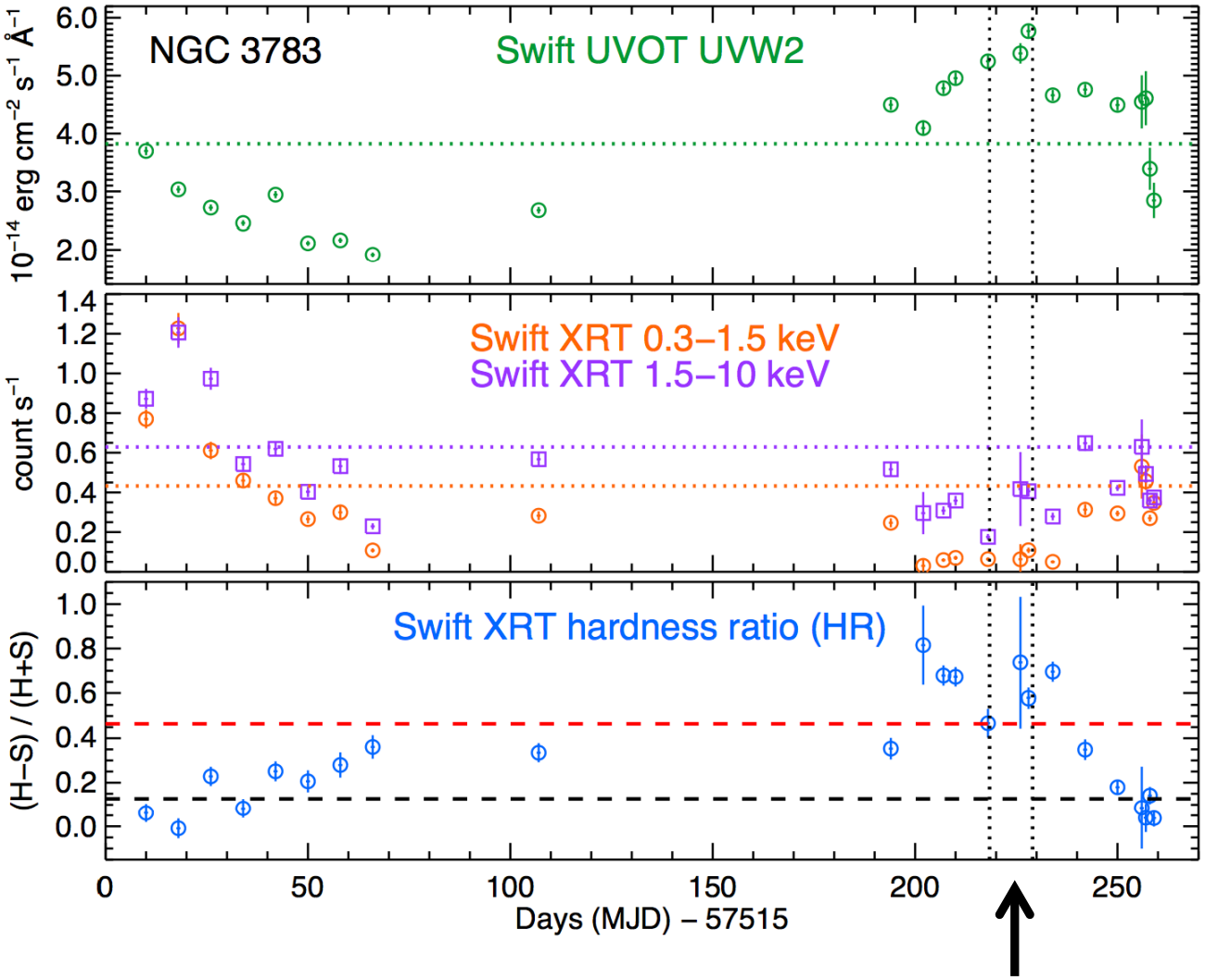
- ✧ XMM-Newton (2 obs)
- ✧ HST/COS (4 orbits)
- ✧ NuSTAR (2 obs)

Weekly Swift observations in 2016-2017

Monitored type-I AGN:

Ark 564, MR 2251-178, Mrk 335, Mrk 509, Mrk 841, NGC 3783, NGC 4593, NGC 7469

Swift lightcurve of NGC 3783



HR triggering limit

ToO with XMM, HST & NuSTAR - Dec 2016

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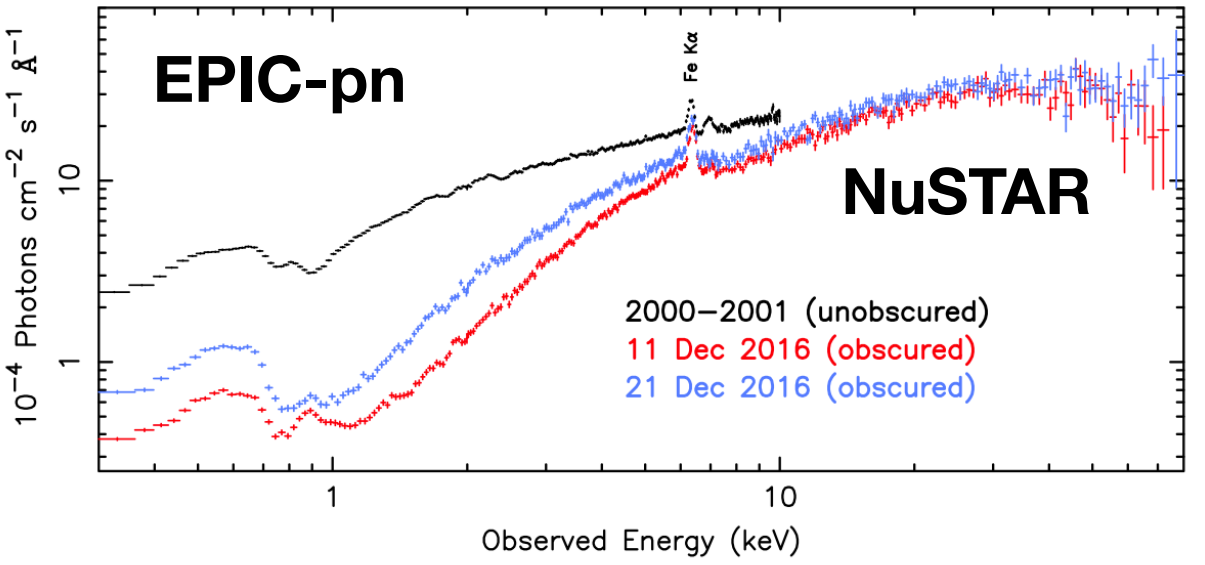
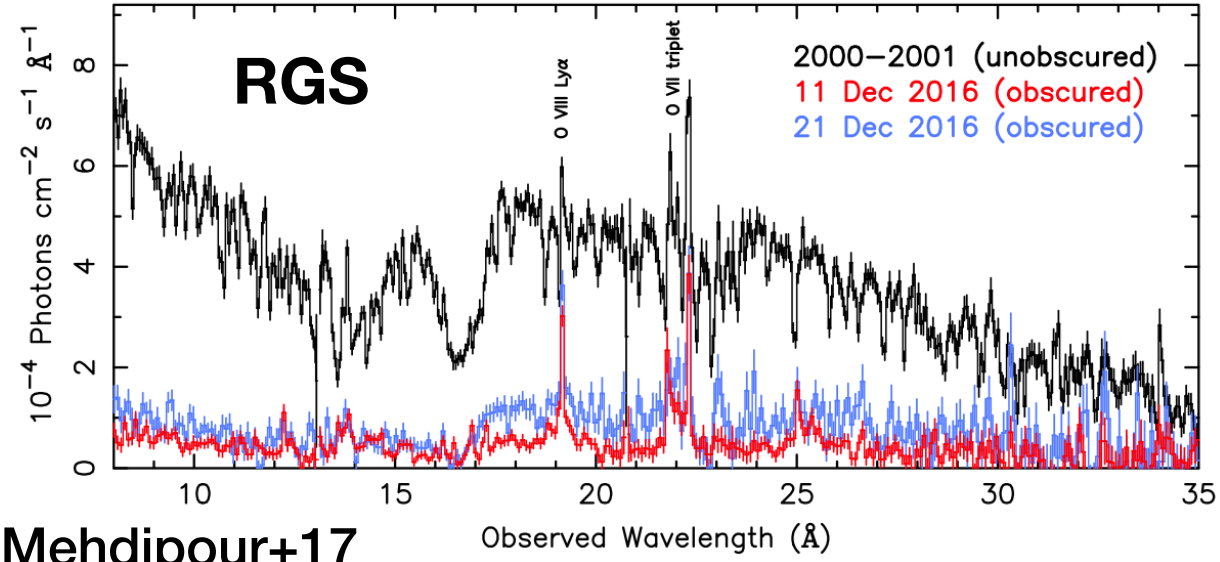
XMM and NuSTAR spectra of NGC 3783





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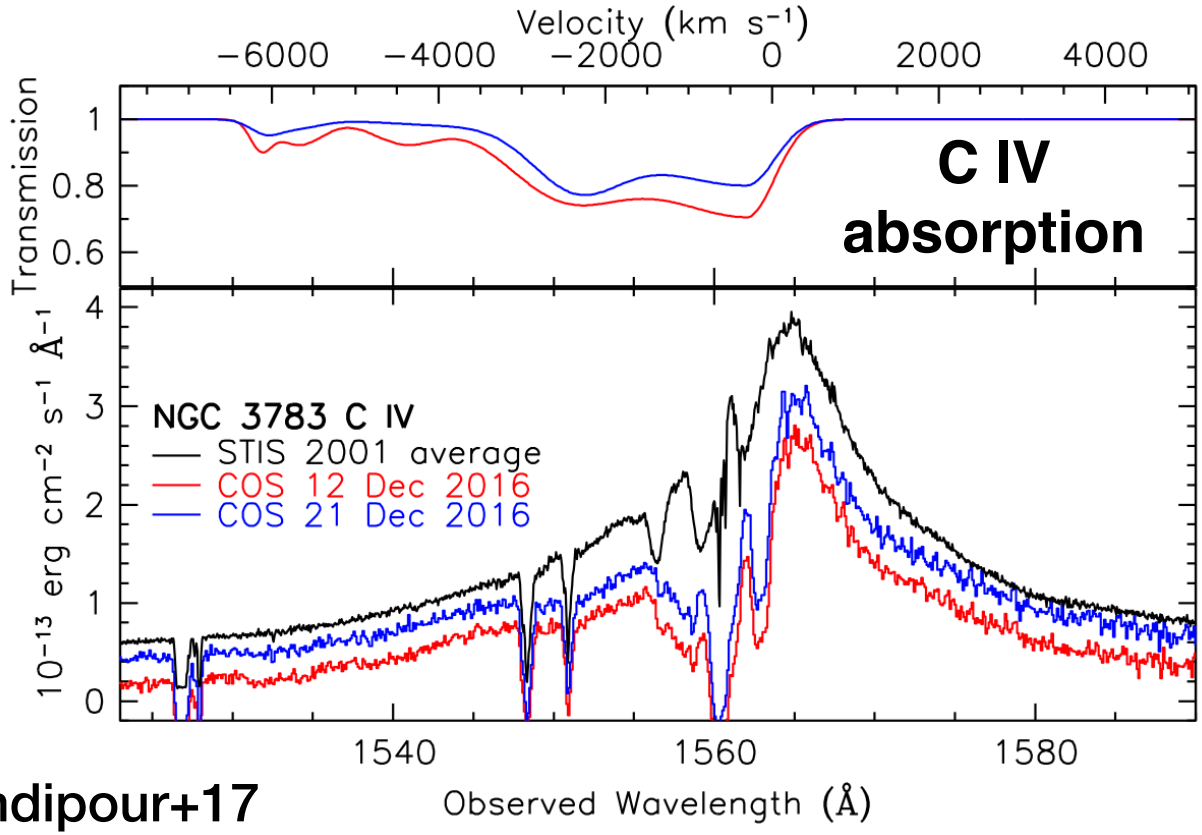
Strong X-ray absorption in Dec. 2016

Intrinsic $\Gamma \sim 1.7$

$N_H \sim 2 \times 10^{23}$ cm^{-2}
$C_f \sim 0.5$

Narrow X-ray emission lines unaffected

HST/COS spectrum of NGC 3783: C IV line



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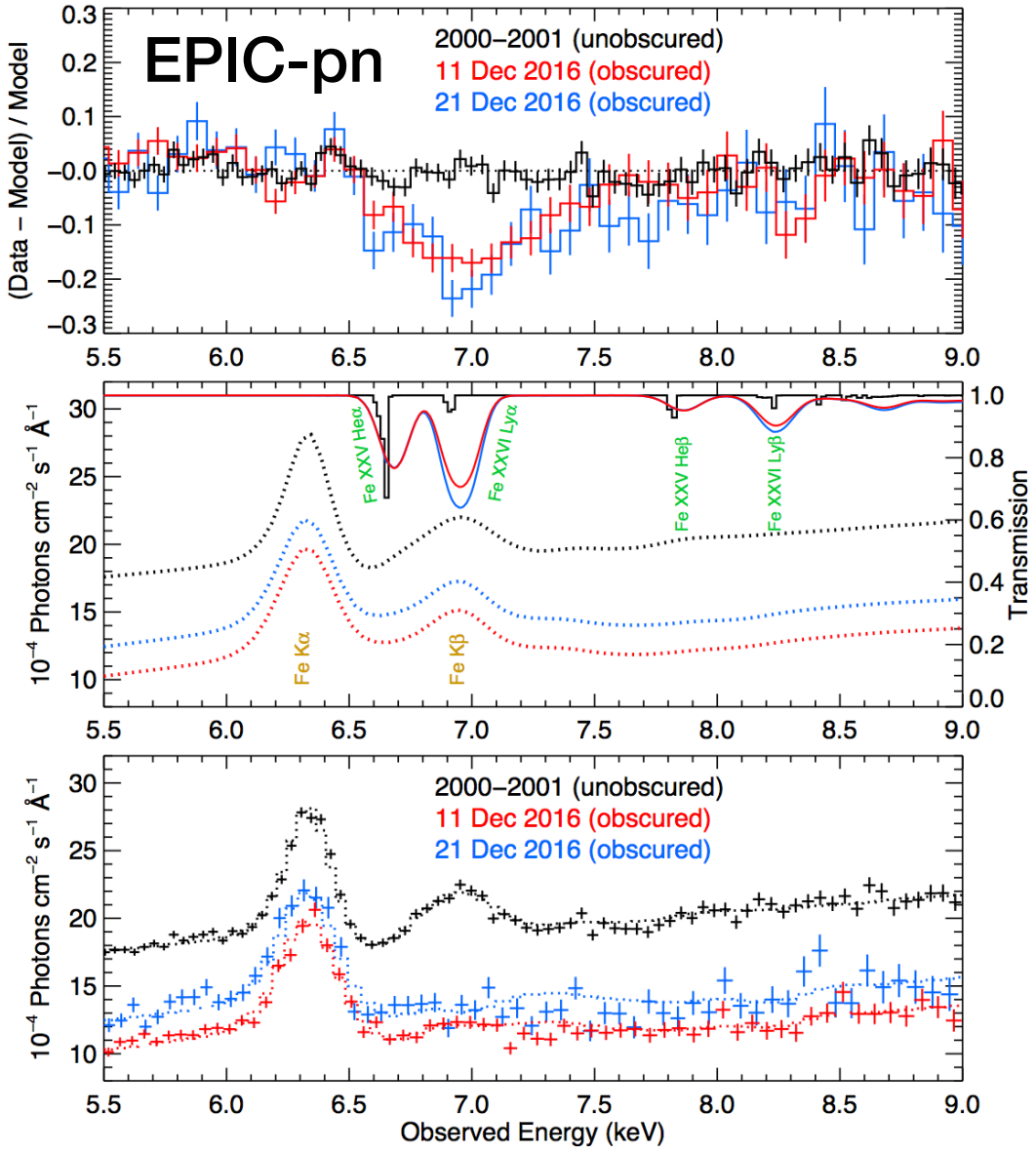
Also seen in N V and Lyα

See the talk by Jerry Kriss

- ✧ Broad, blue-shifted absorption appears when obscured
- ✧ Photoionisation modelling ➔ ionisation of the obscurer: log ξ ~ 1.8 (more ionised than the obscurer in NGC 5548)

Line absorption in the Fe K band when obscured



Appearance of a new high-ionisation component in 2016

Outflow velocity: few thousand km/s (similar to C IV in UV)

$N_H \sim 2 \times 10^{23}$ cm^{-2}

Fe XXVI Lyα absorption diminishes Fe Kβ line

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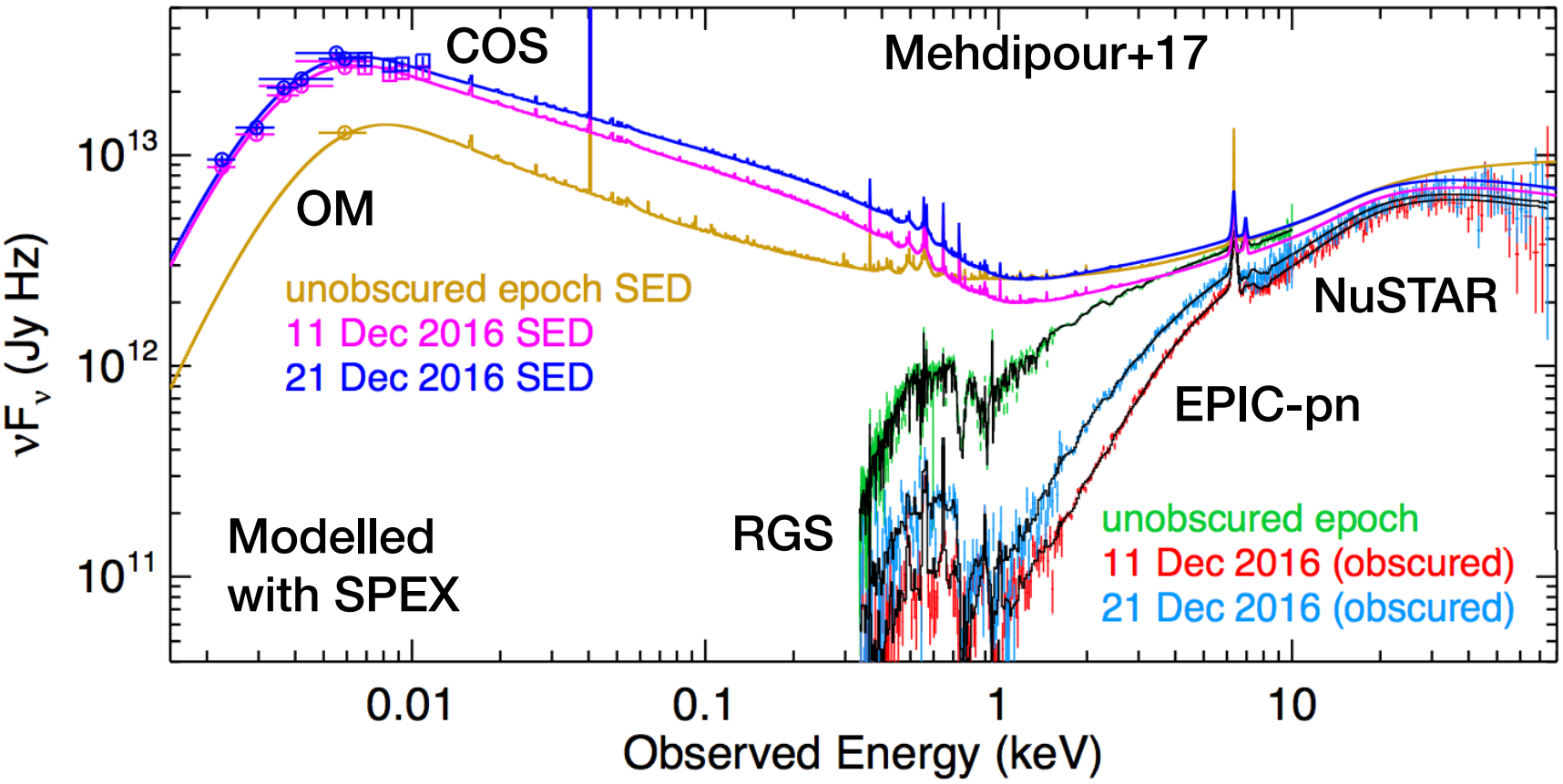
Line absorption associated to transient X-ray obscuration in type-I AGN

Transient X-ray obscuration associated with:

1) transient broad, blue-shifted UV absorption
   - Mrk 335 (Longinotti+13)
   - NGC 5548 (Kaastra+14)
   - NGC 985 (Ebrero+16)
   - NGC 3783 (Mehdipour+17)

2) transient high-ionisation component
   - NGC 3516 (Turner+08)
   - PDS 456 (Reeves+09)
   - NGC 3783 (Mehdipour+17)

X-ray obscuring wind in NGC 3783



- ✧ Obscurer N_H ~2 × 10^{23} cm^{-2}, C_f ~0.5, log ξ ~1.8, v ~few 10^3 km/s
- ✧ Two partially-covering absorption components ➔ clumpy
- ✧ Ionising luminosity higher when obscured

X-ray obscuring wind in NGC 3783

From our modelling we find obscurer density ~ 3×10^9 cm^{-3}
Obscurer radius ~ 10 light days ➔ outer BLR

BLR radius ~ 1.4 (He II) to 10.2 (Hβ) light days (Peterson+04)
torus radius ~ 250-357 light days (Beckert+08)
WA radius ~ pc scale (Behar+03; Gabel+05)

X-ray eclipses in NGC 1365 and Mrk 766 also produced by BLR clouds (Risaliti+07,+11)

Consistent with clouds in the base of a radiatively-driven disk wind at the BLR of the AGN (Murray+95)

Shielding of X-rays by obscurer prevents over-ionisation ➔ radiative acceleration through UV line absorption (Proga+04)

Summary

- ✧ Transient X-ray obscurer in NGC 3783 is outflowing at few thousand km/s
- ✧ Density and location of the X-ray obscurer matches the BLR. Properties different from warm absorbers
- ✧ X-ray obscuration associated with transient UV and high-ionisation line absorption
- ✧ X-ray obscuration consistent with clouds at the base of a radiatively-driven disk wind
- ✧ ToO multi-wavelength spectroscopy is an effective way to probe the link between the disk, BLR, and outflows

Supplementary slides

Absorption model components