The Obscuration Transient Event in NGC 3227 during 2019

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New Results in X-ray Astronomy

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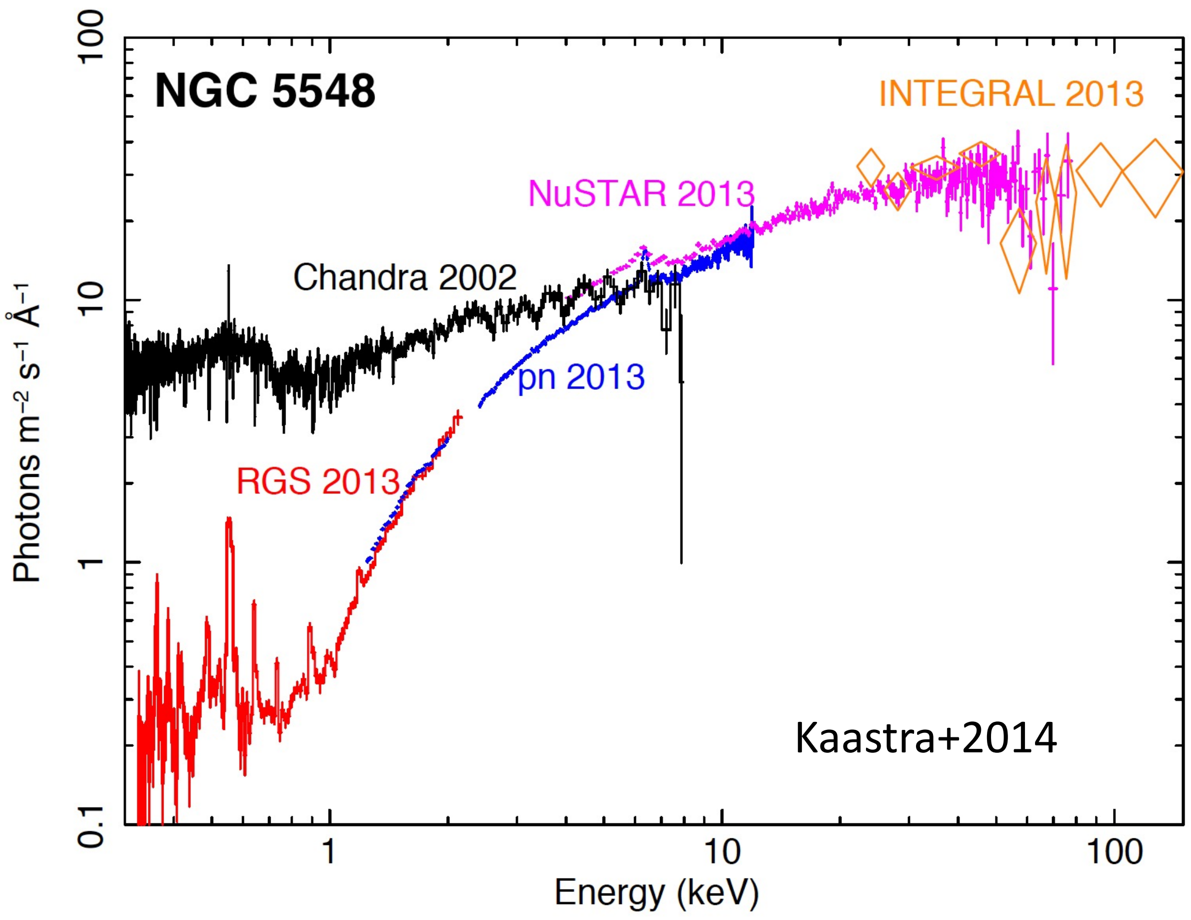
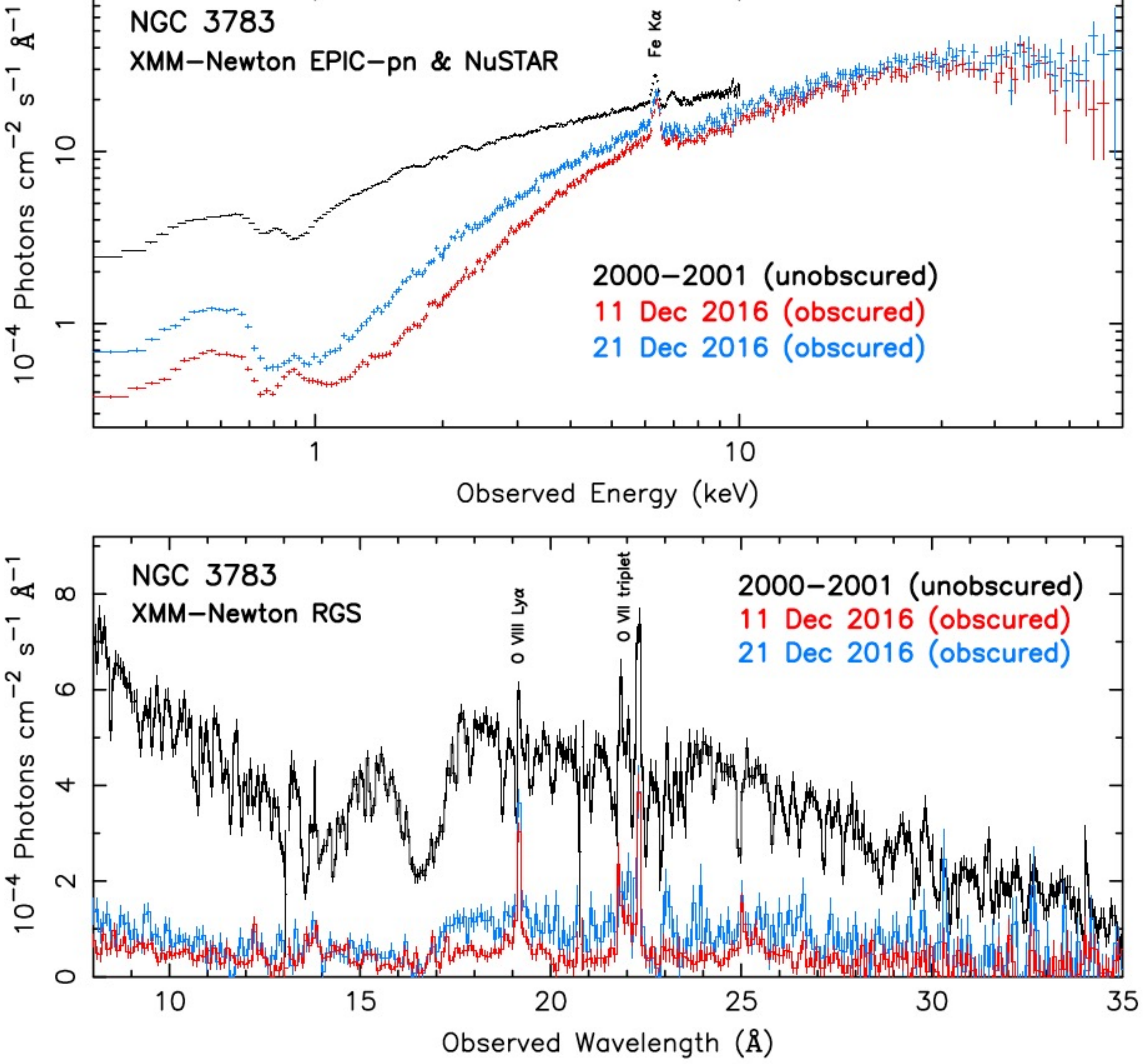
Obscuration in other AGN



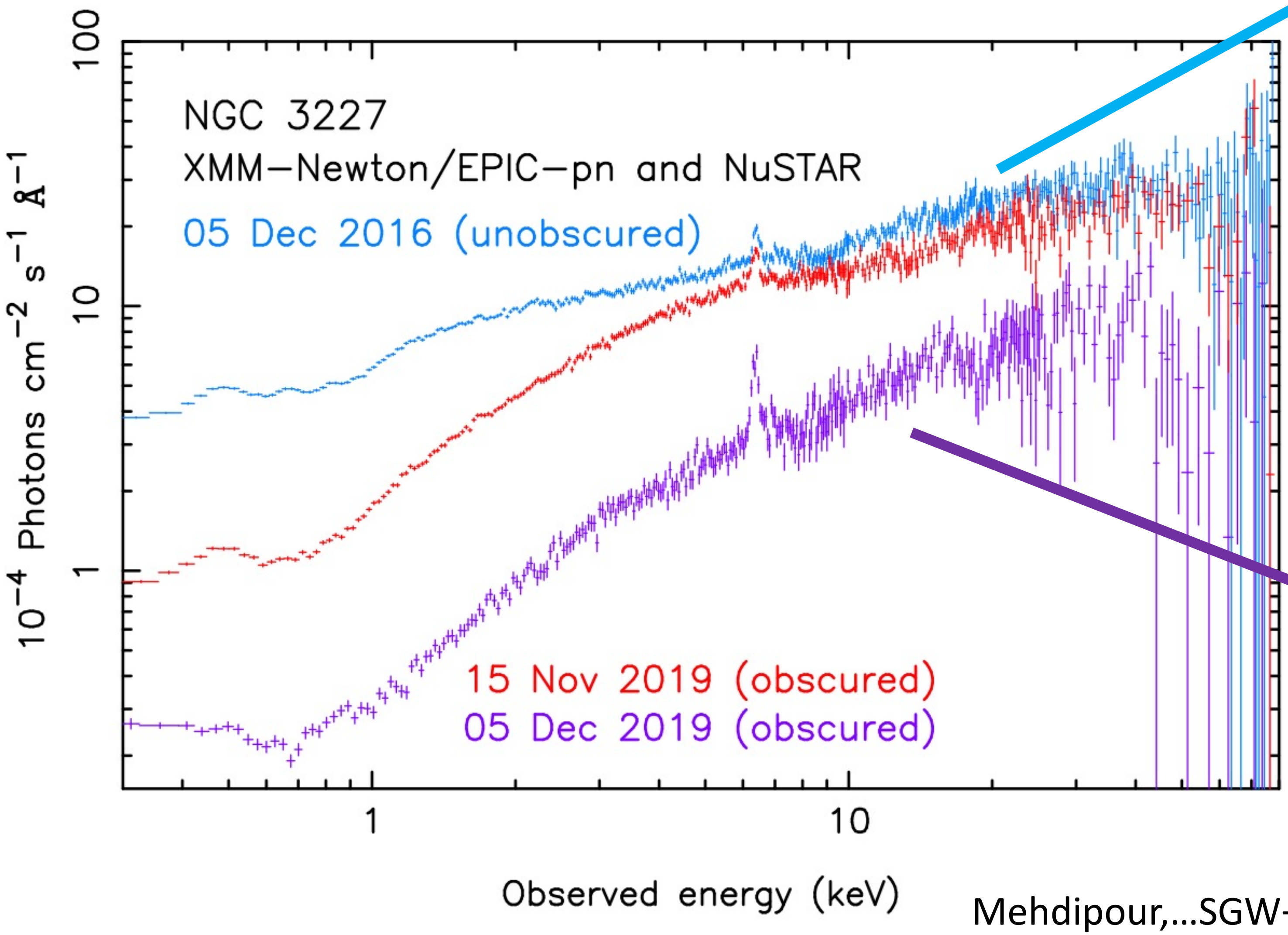


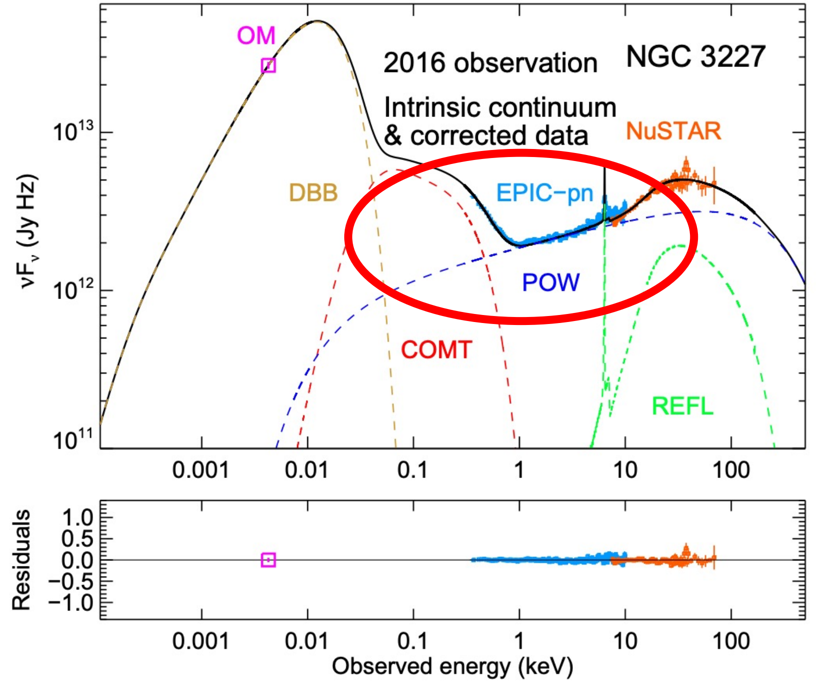
Mehdipour+2017

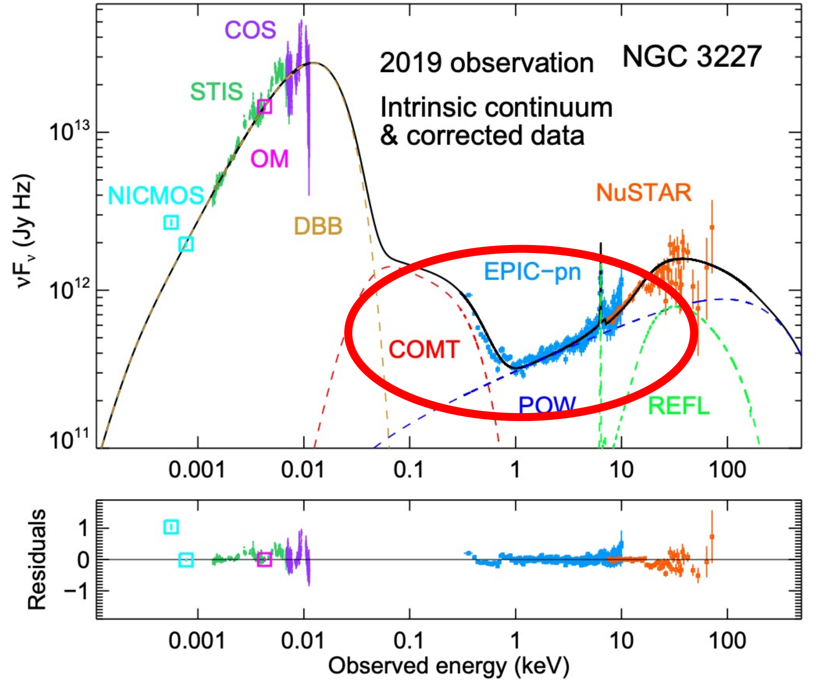
More examples:

Mrk 335 (Longinotti et al. 2013, 2019; Parker et al. 2019), NGC 985 (Ebrero et al. 2016), NGC 3227 (Turner et al. 2018), and ESO 033-G002 (Walton et al. 2021).

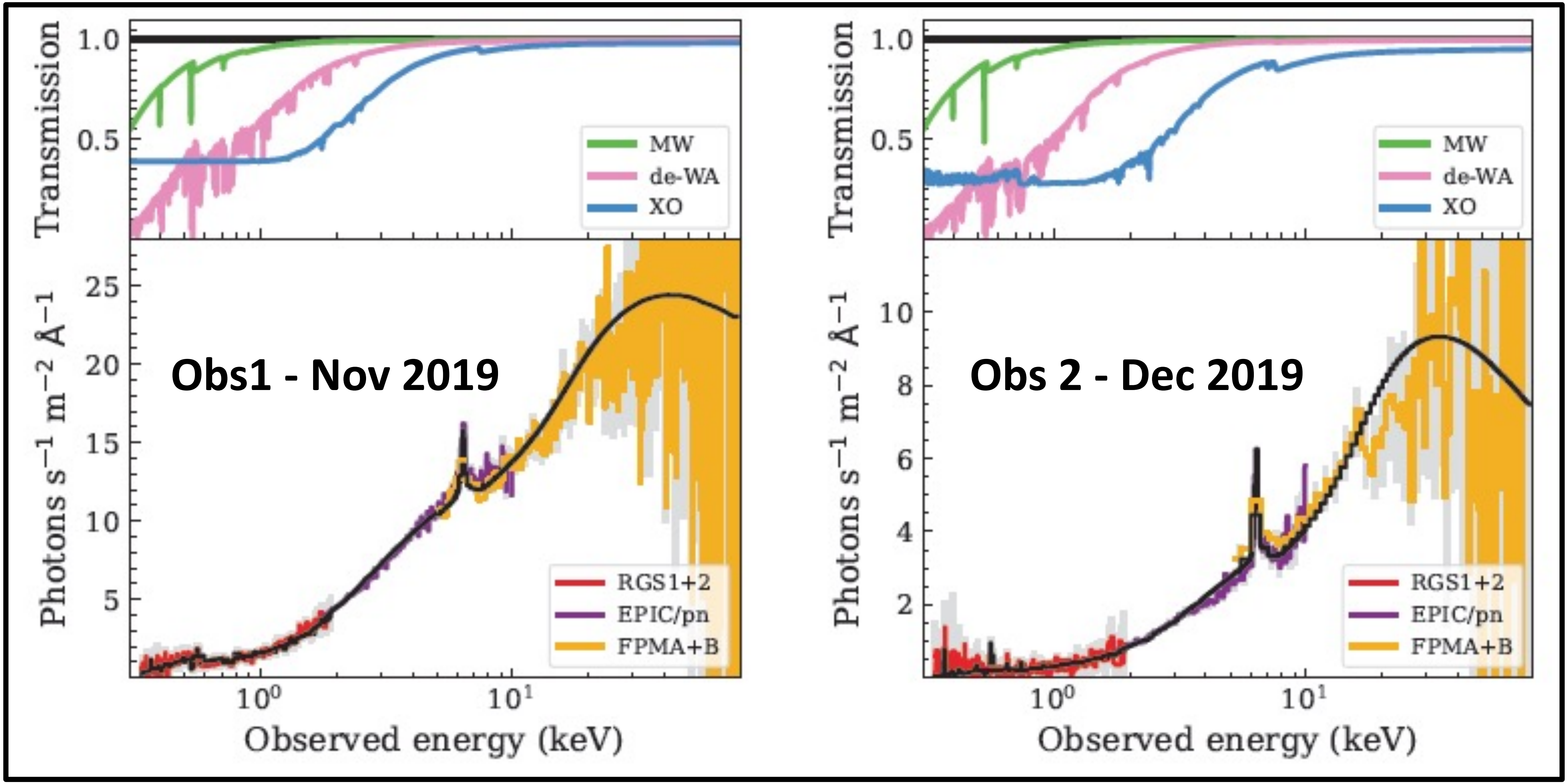
2019 Obscuration Campaign of NGC 3227





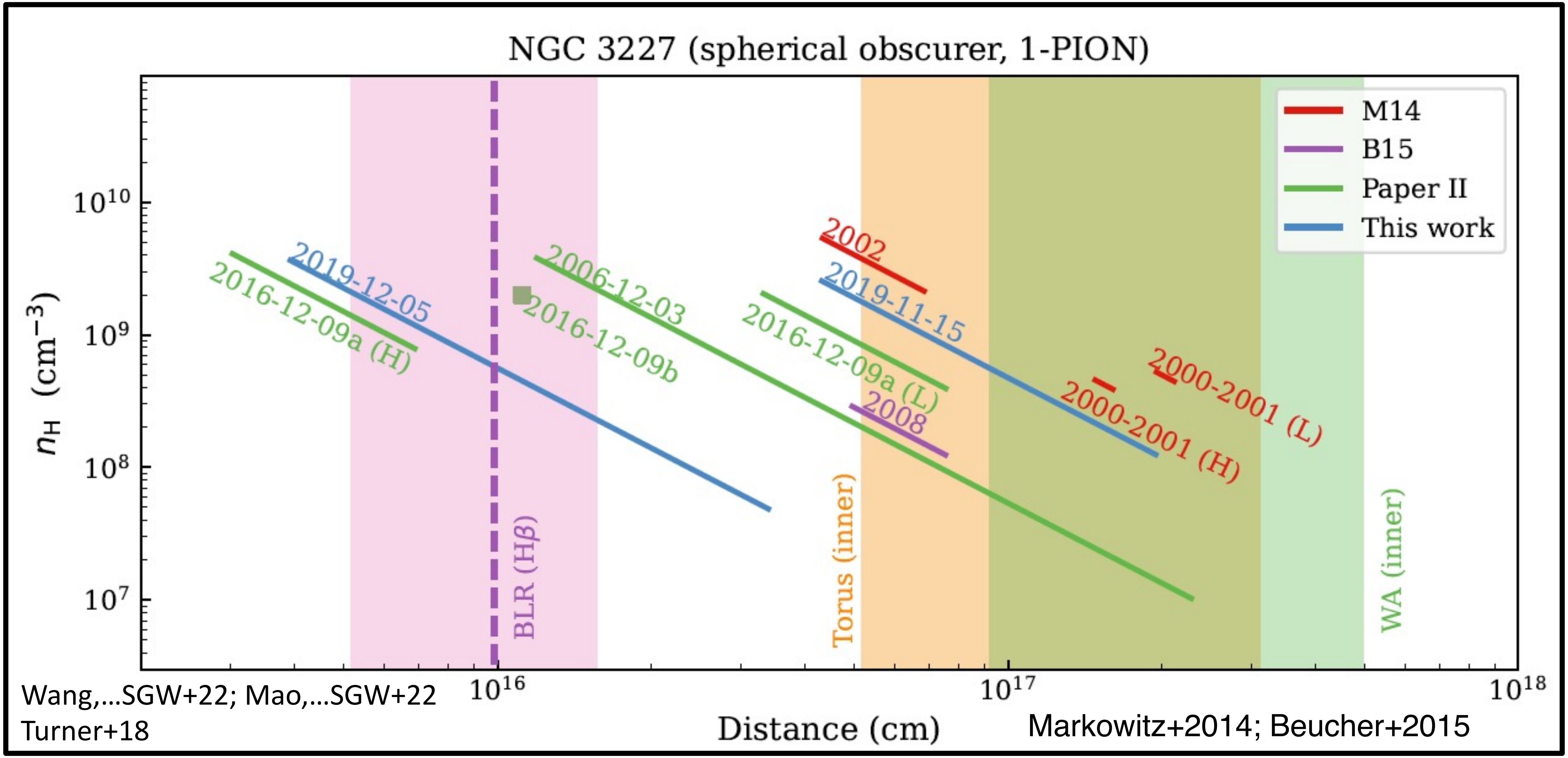


Mehdipour,…SGW+2021

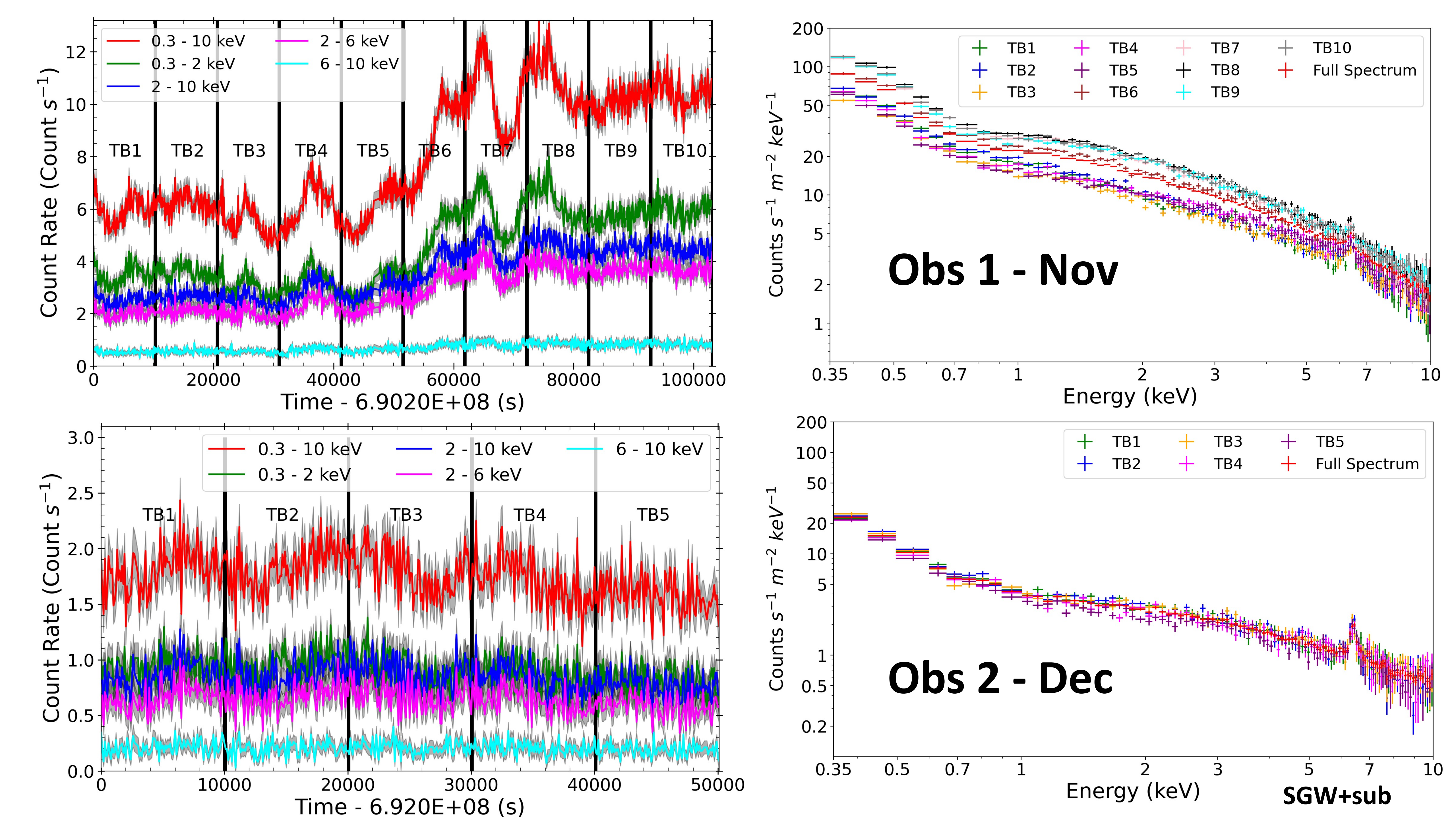


Mao,...SGW+22

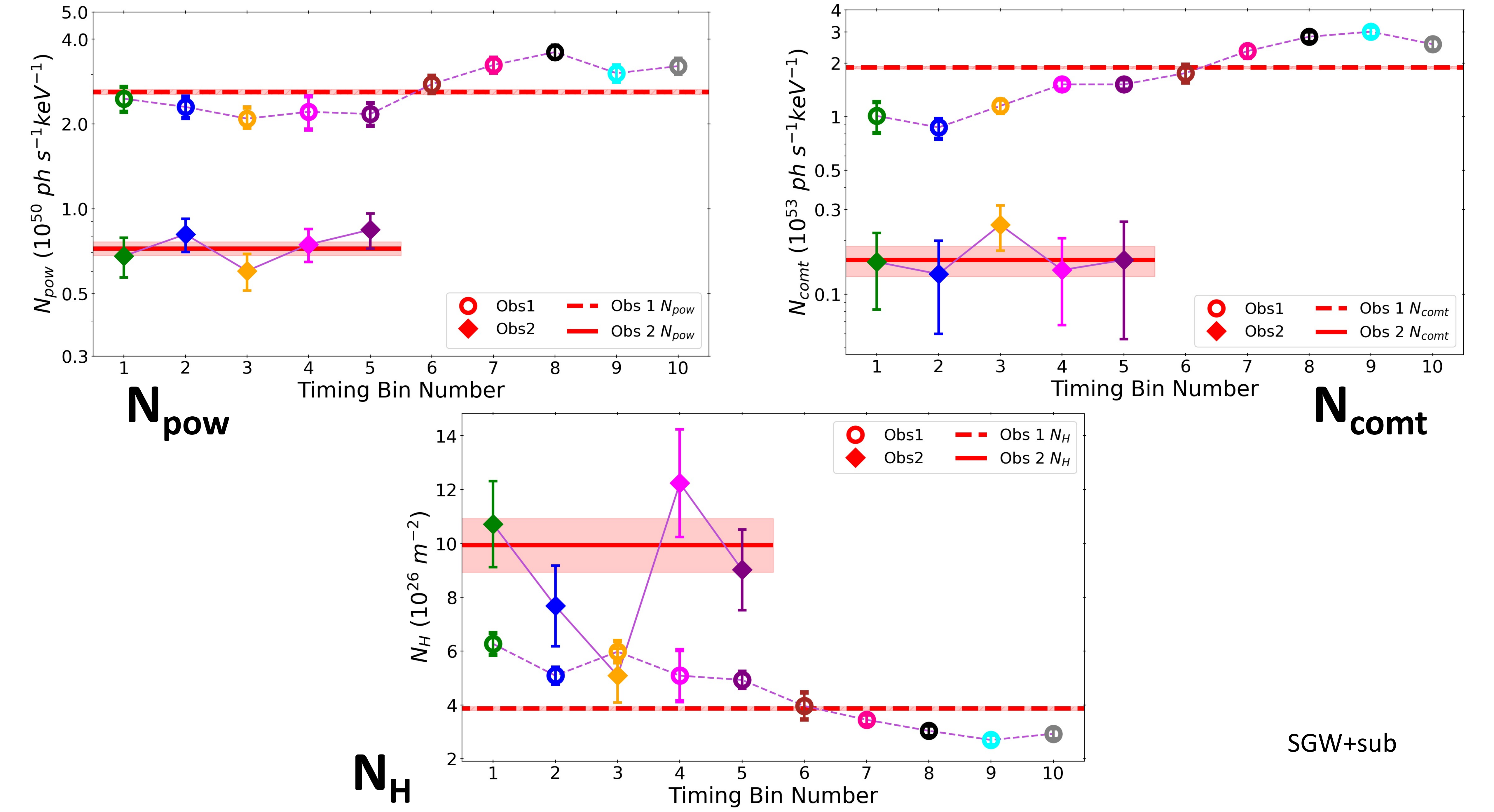
- **Obs 1: log ξ = 0.4; L_{ion} = 11.7 x 10^{35} W**
- **Obs 2: log ξ = 1.8; L_{ion} = 5.8 x 10^{35} W**



Consistent with the locations of the obscurers in NGC 5548 (Kaastra+14) and NGC 3783 (Mehdipour+2017; Mao+2018)

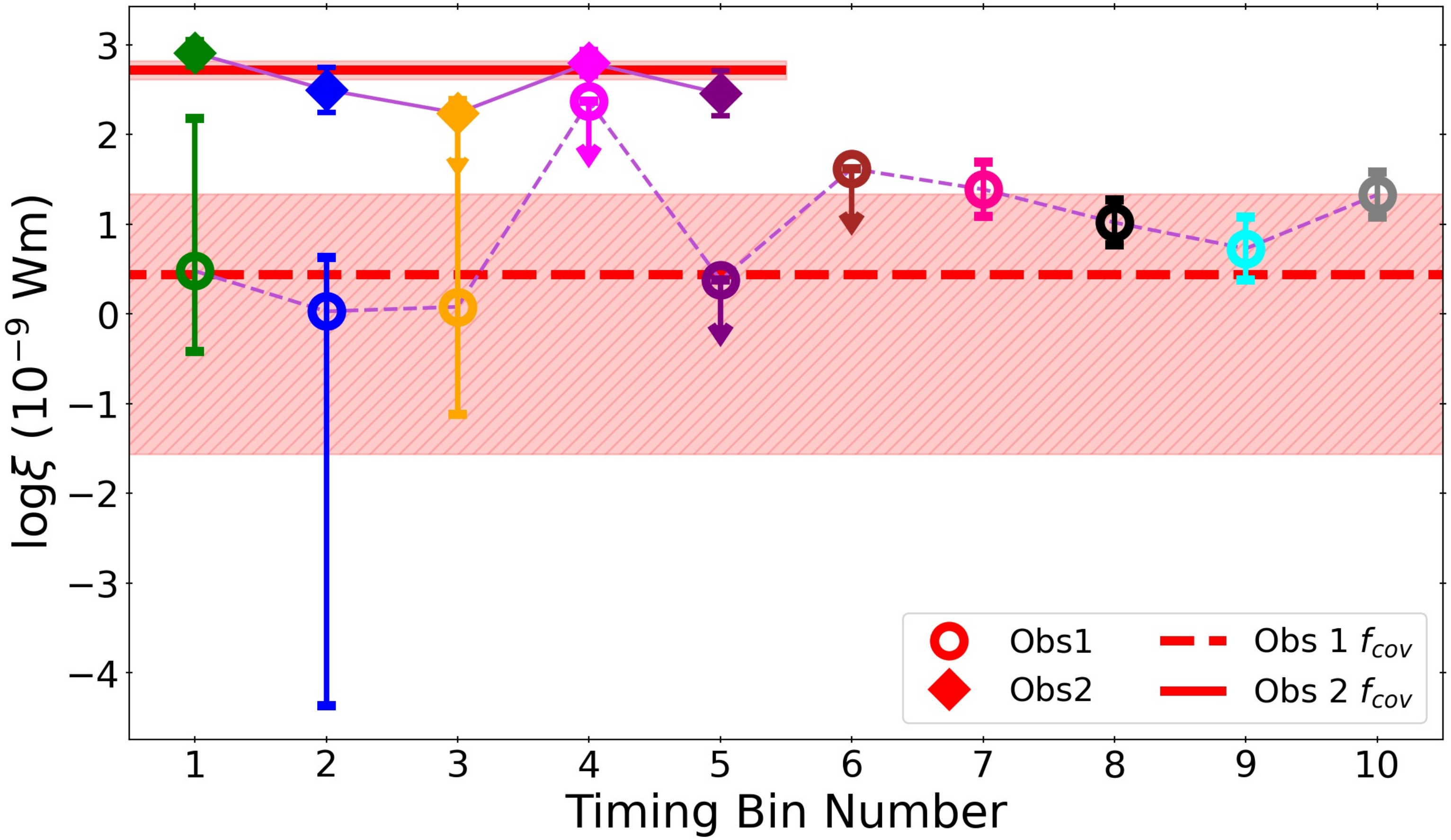


0.3 - 10 keV
0.3 - 2 keV
2 - 10 keV
2 - 6 keV
6 - 10 keV
TB1 TB2 TB3 TB4 TB5 TB6 TB7 TB8 TB9 TB10
Count Rate (Count s^{-1})
Time - 6.9020E+08 (s)
TB1 TB2 TB3 TB4 TB5 TB6 TB7 TB8 TB9 TB10 Full Spectrum
Counts s^{-1} m^{-2} keV^{-1}
Energy (keV)
Obs 1 - Nov
TB1 TB2 TB3 TB4 TB5
Time - 6.920E+08 (s)
TB1 TB2 TB3 TB4 TB5 Full Spectrum
Obs 2 - Dec
SGW+sub



N_{pow} (10^{50} $ph\ s^{-1} keV^{-1}$)
Timing Bin Number
Obs1
Obs2
Obs 1 N_{pow}
Obs 2 N_{pow}
N_{pow}
N_{comt} (10^{53} $ph\ s^{-1} keV^{-1}$)
Timing Bin Number
Obs1
Obs2
Obs 1 N_{comt}
Obs 2 N_{comt}
N_{comt}
N_H (10^{26} m^{-2})
Timing Bin Number
Obs1
Obs2
Obs 1 N_H
Obs 2 N_H
N_H
SGW+sub

log ξ



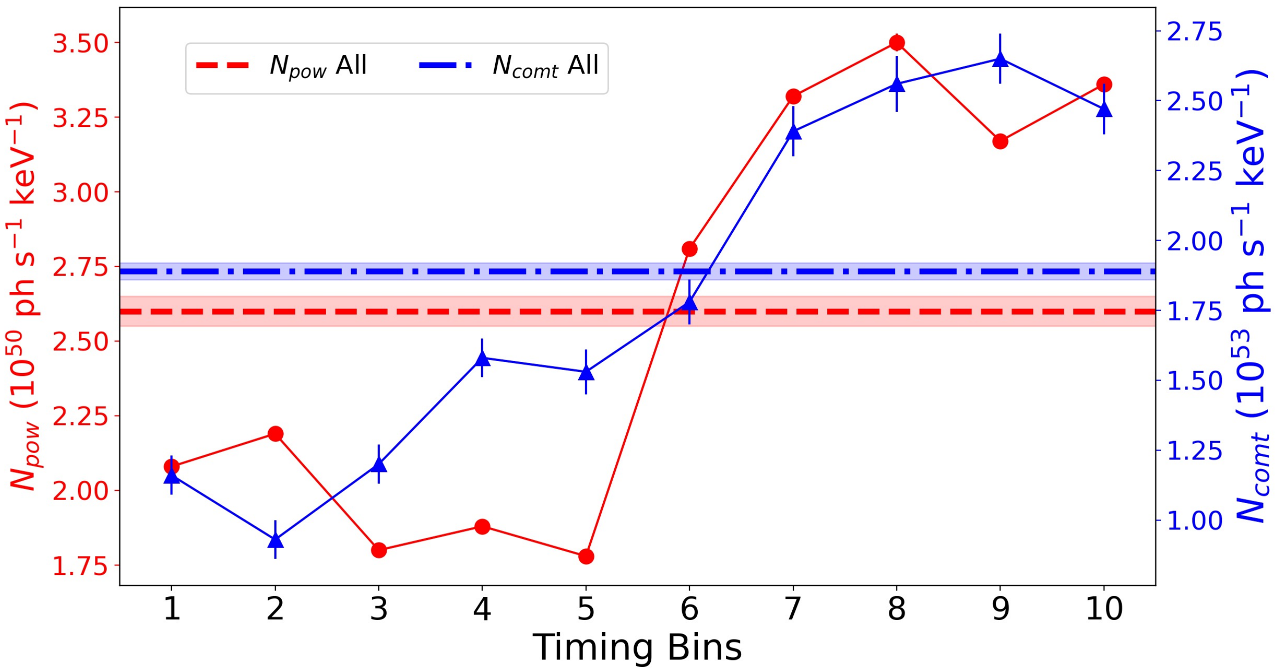
SGW+sub

Large uncertainties for Obs 1 implies:

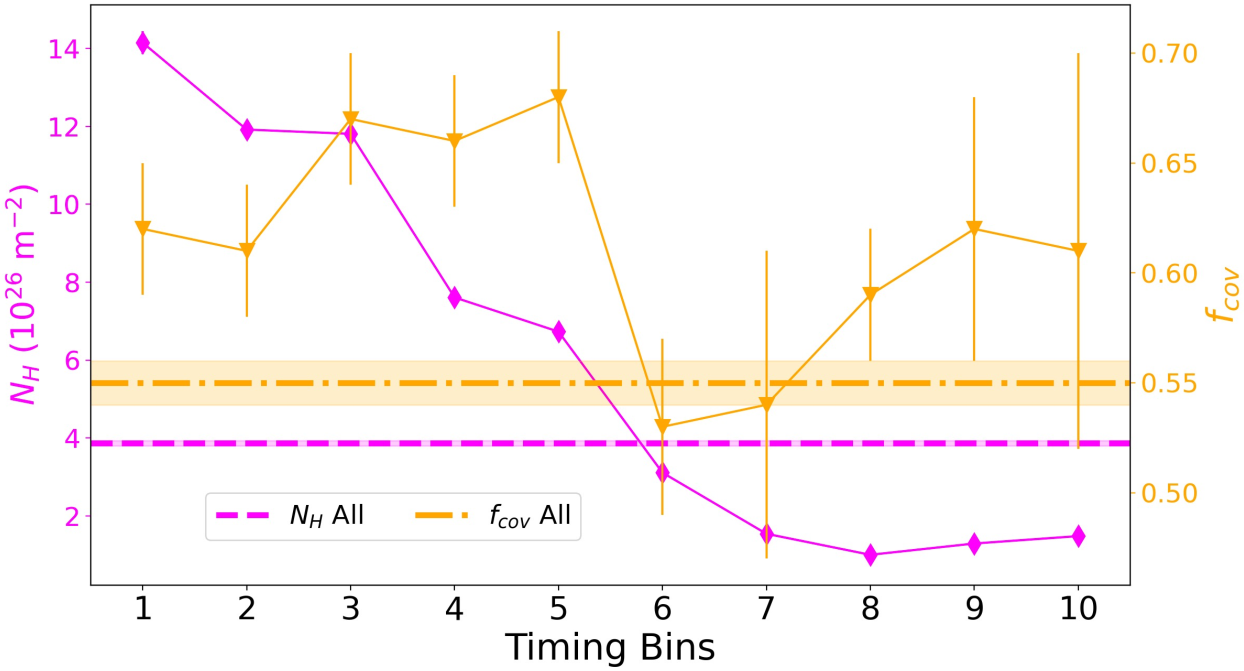
1. Cannot conclude whether **ξ** varies or not with the continuum.
2. We are observing an inhomogeneous obscurer made up of multiple components
   - Different parameter ranges
   - Any global change would be hard to identify with a single model Component.

Carried out further tests in Obs 1

- Fixed obscurer parameters
- Fitted continuum



- Fixed continuum parameters
- Fitted obscurer



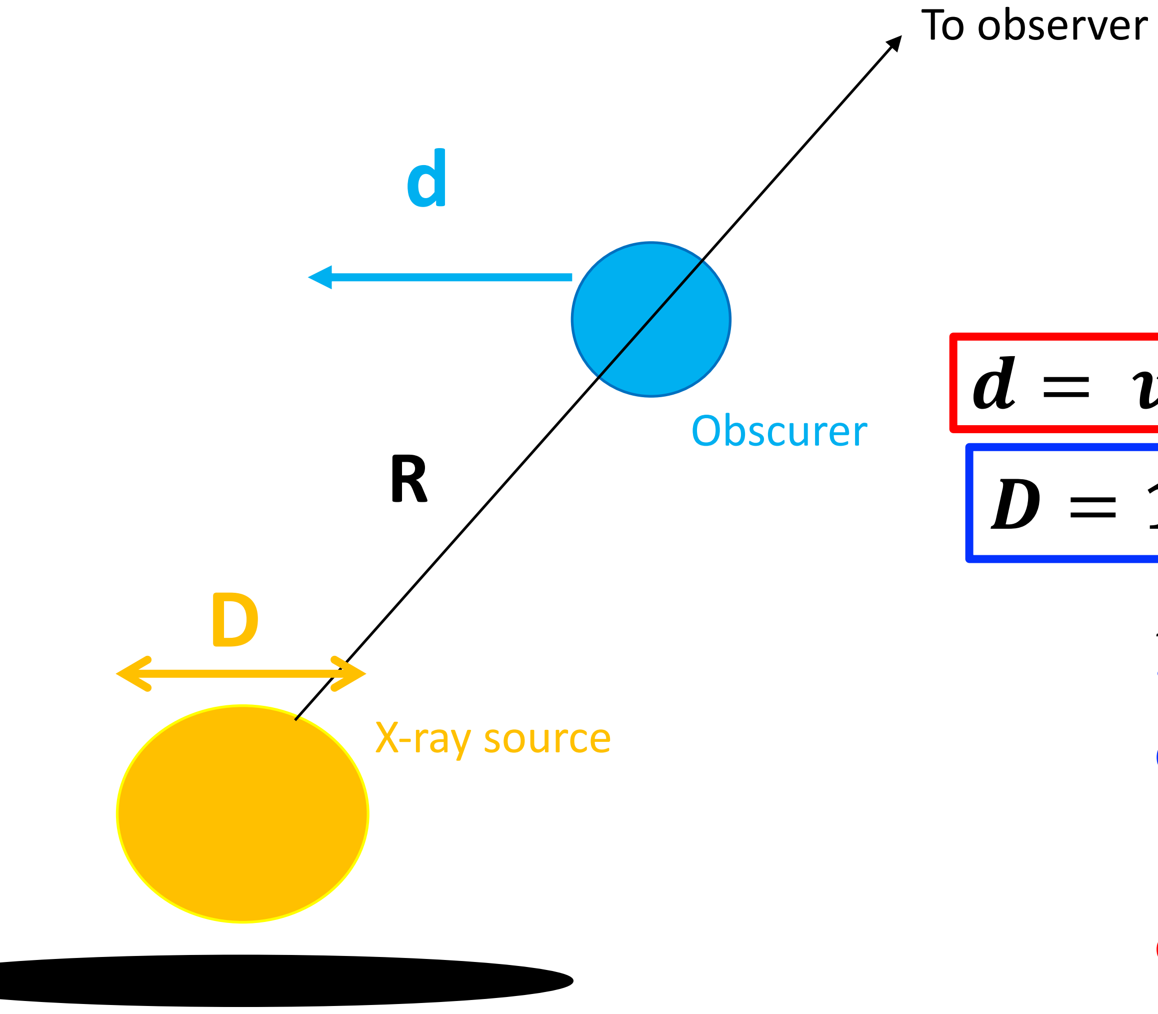
SGW+sub

Two scenarios:

1) Continuum varies and as a consequence so does the obscurer
2) Obscurer varies independently of the continuum changes

But what causes the changes in the column density?

- Obscurer moves transversely across our LOS to the X-ray source



$M_{BH} = 5.96 \times 10^{6}\ M_{\odot}$

$R \sim 3.70 \times 10^{14} - 1.70 \times 10^{15}$ m (Mao+22)

$v_{cross} = \sqrt{\frac{GM_{BH}}{R}} = 680 - 1470$ km s^{-1}

$\Delta t \sim 100$ ks (Obs 1)

$d = v_{cross}\,\Delta t = 6.80 \times 10^{10} - 1.51 \times 10^{11}$ m

$D = 1.24 - 2.65 \times 10^{11}$ m (Chainakun+2019)

$D \sim d$

i.e. there is an overlap in both the coronal size and the distance travelled by the obscurer in Obs 1.

∴ changes in the obscurer column density for Obs 1 could be explained with the obscurer moving transversely across our LOS towards the X-ray corona.

Summary

- Apparent anti-correlation between N_H and N_{pow}, N_{comt} in Obs 1
- Observed variability in Obs 1 is likely to be driven by the continuum
- But cannot rule out changes caused by N_H if the obscurer moves transversely across the X-ray source within our LOS
- No evidence of change in ξ of the obscurer
  - Explained if the obscurer is multi-phased – fitted here with only one component
- Obs 2 shows little change over the course of the observation

Thank you for listening