AGN STORM 2: Photoionized emission and absorption features in the high-resolution X-ray spectra of Mrk 817

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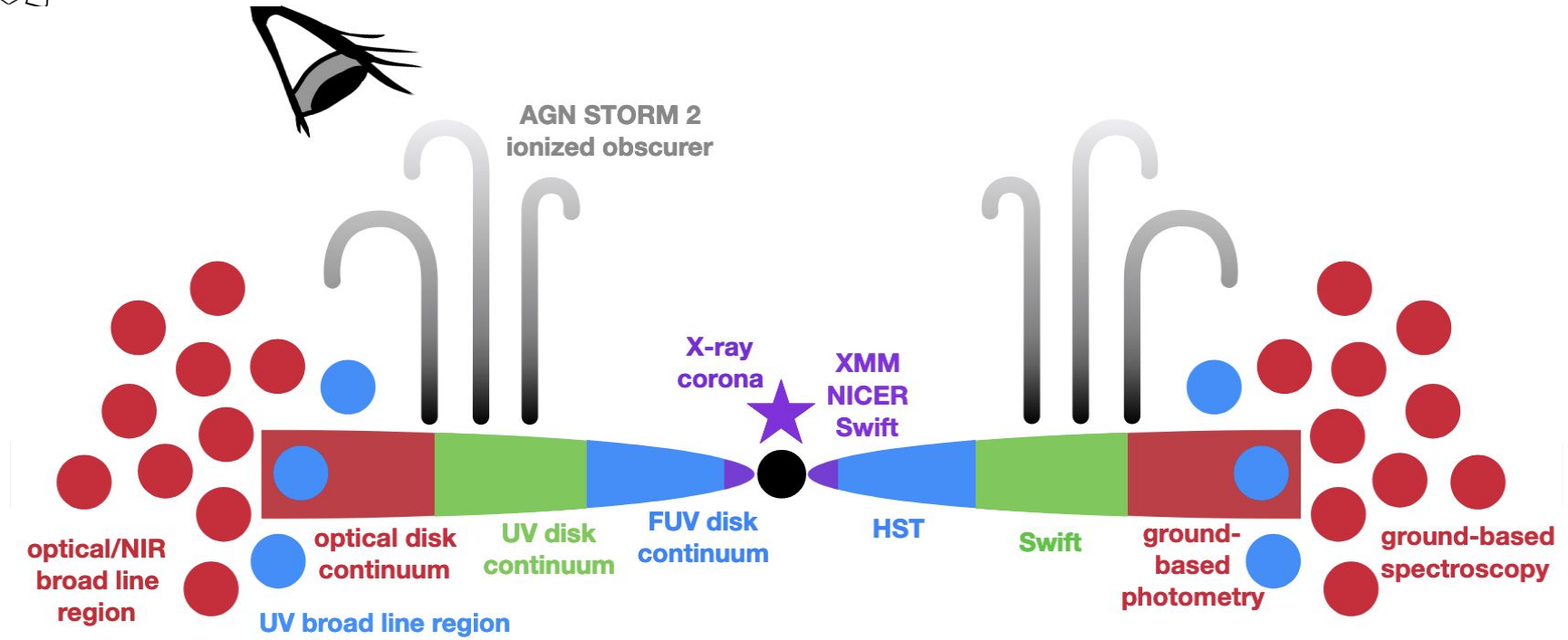
2nd year Grad student
Supervisors: Erin Kara, Peter Kosec

Image Credit: NASA, ESA, Hubble SM4 ERO Team

Photoionized emission and absorption features in the high-resolution X-ray spectra of Mrk 817



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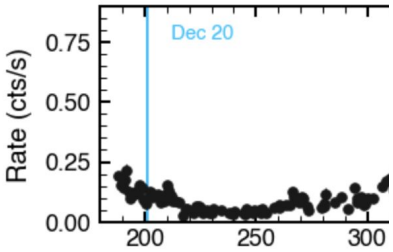
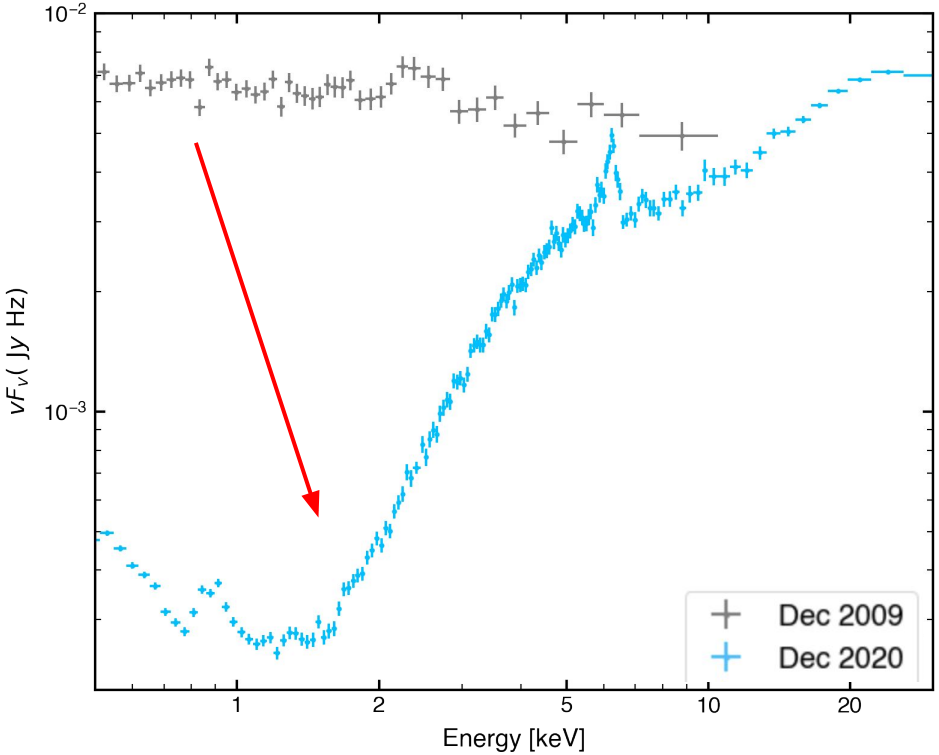
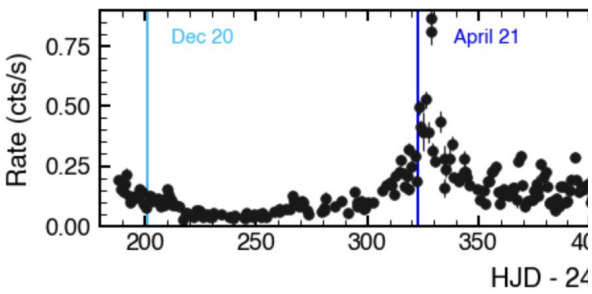
Space Telescope and Optical Reverberation Mapping Project 2

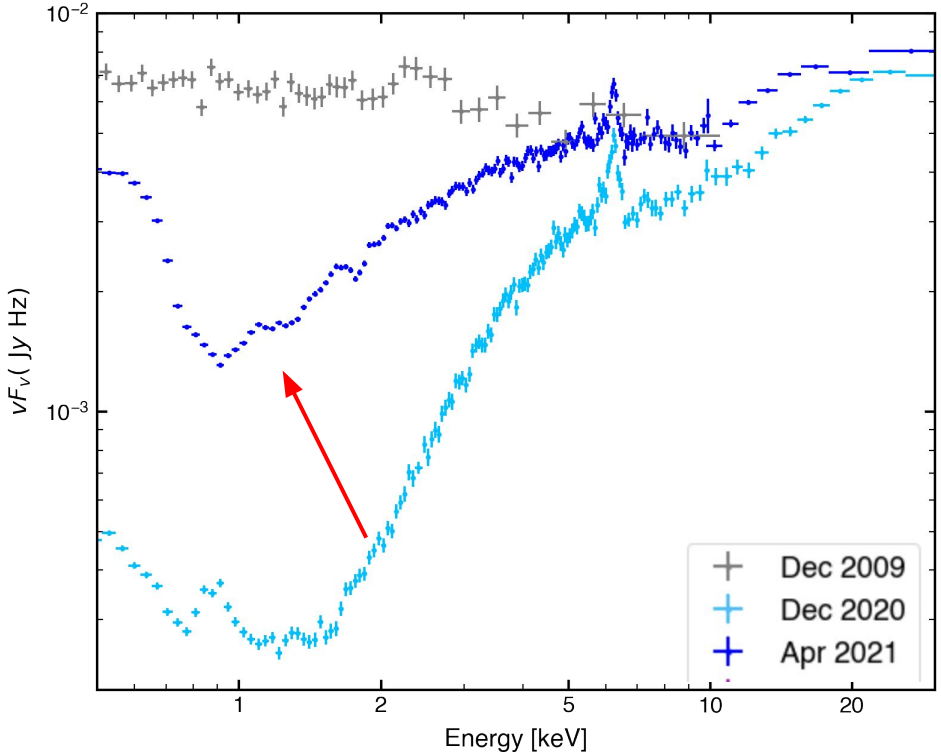
X-ray Campaign



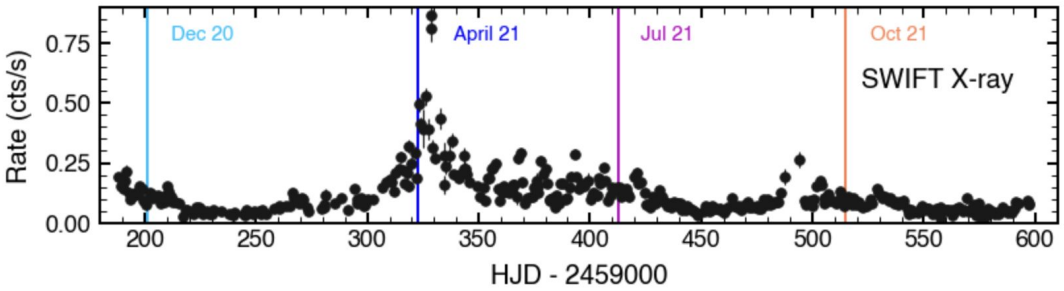


X-ray Campaign

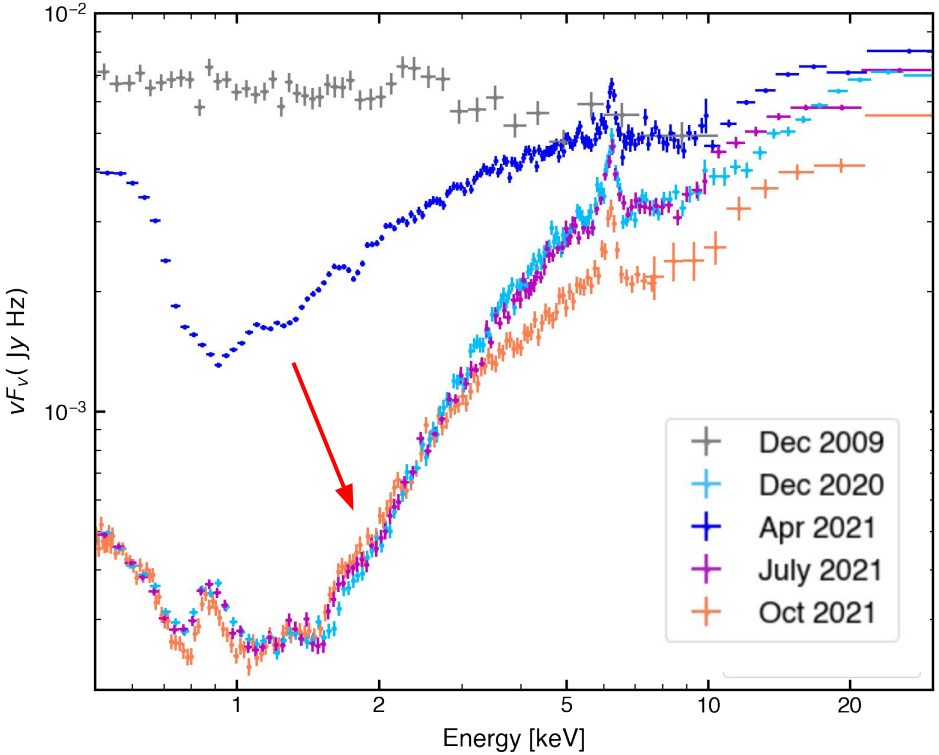




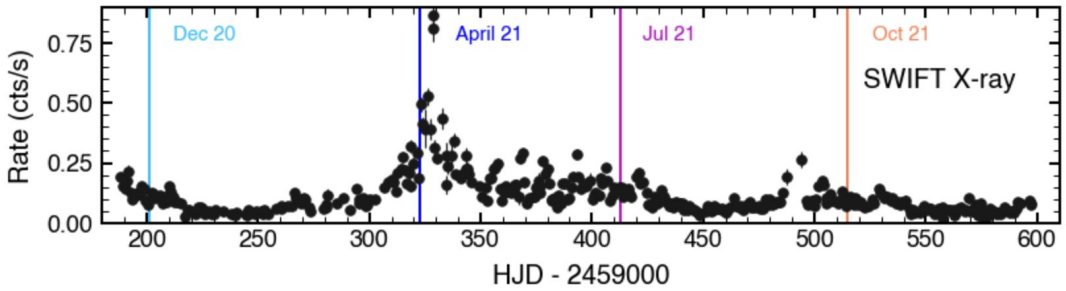
X-ray Campaign



Credit: Ed Cackett



X-ray Campaign



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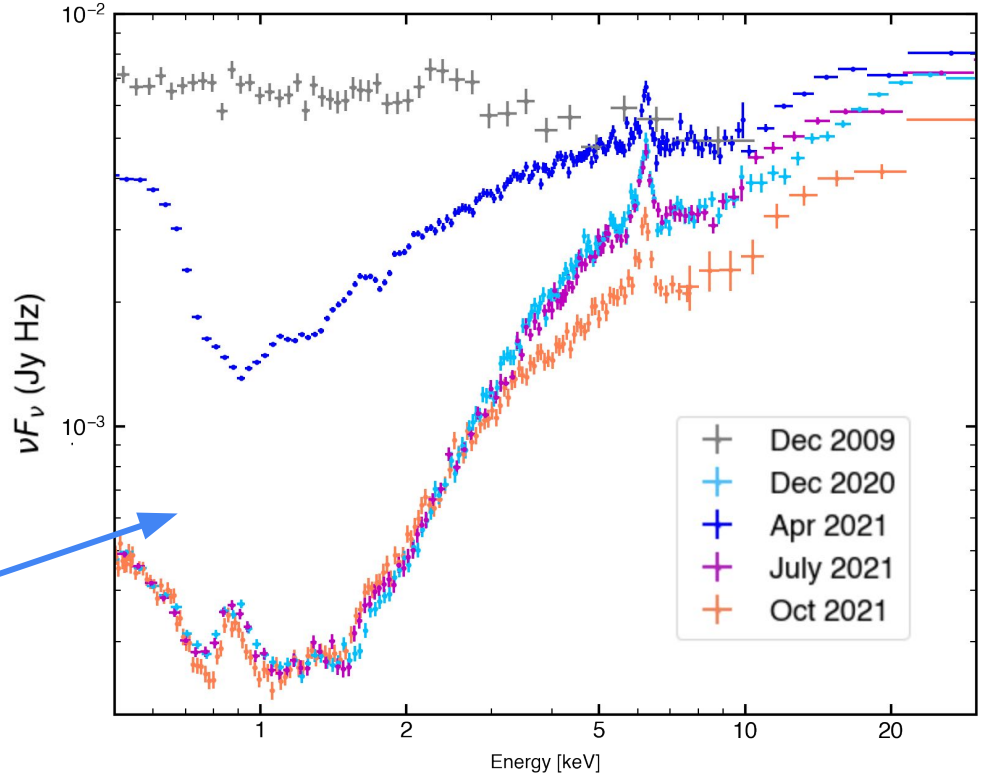
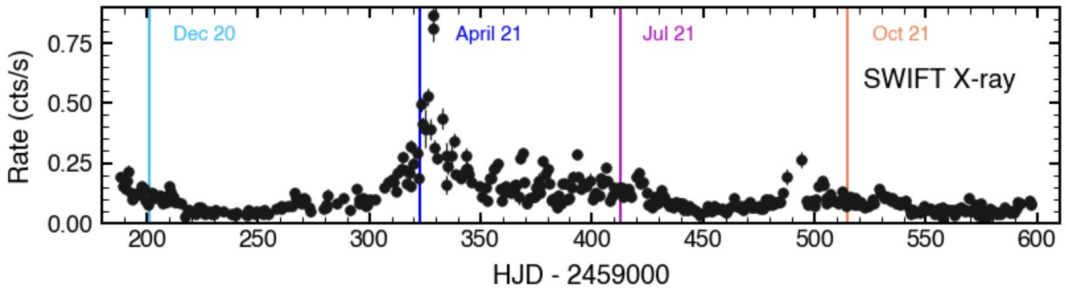


Soft X-ray variability: obscuration

X-ray Campaign



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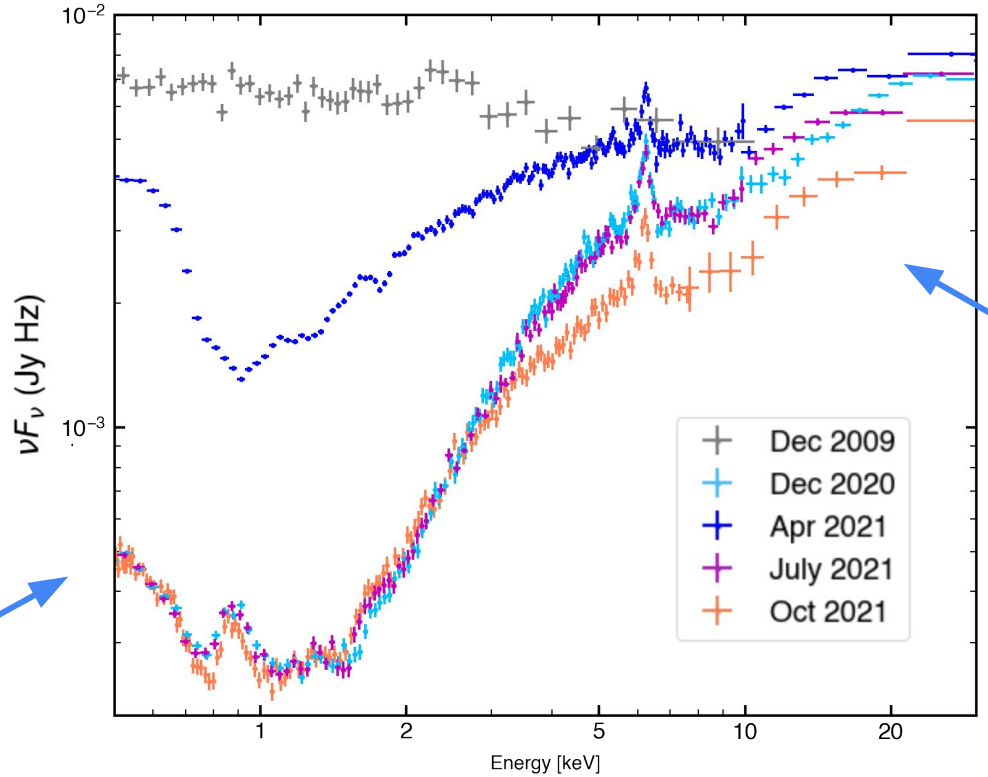
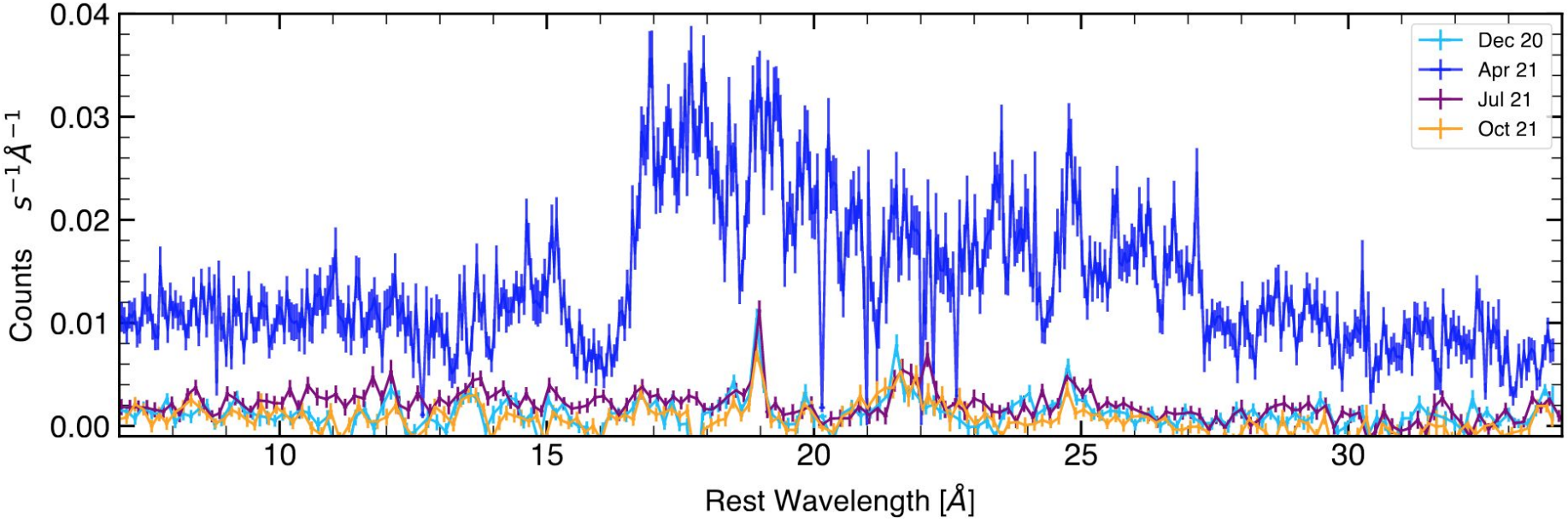


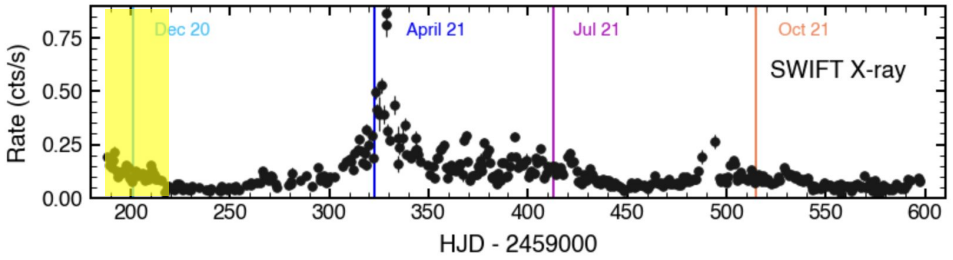
Soft X-ray variability: obscuration

Hard X-ray variability: intrinsic

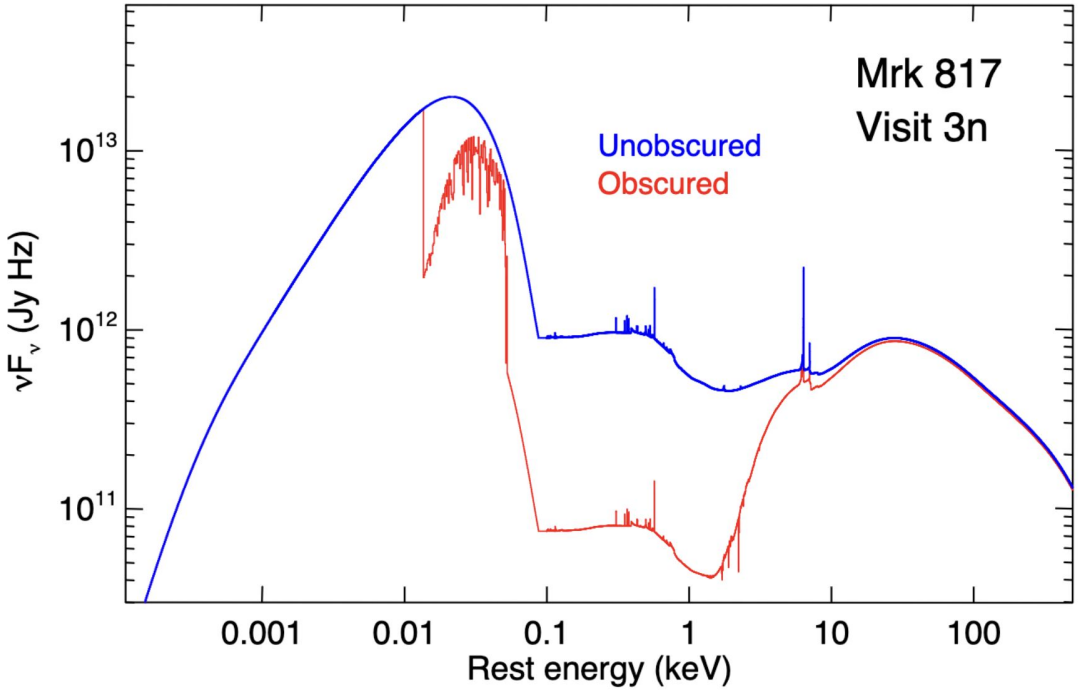
RGS data


0.04
0.03
0.02
0.01
0.00
Counts $s^{-1}Å^{-1}$
10
15
20
25
30
Rest Wavelength [Å]
Dec 20
Apr 21
Jul 21
Oct 21

The Spectral Energy Distribution (Dec 2020)



tbabs* (pion xs+ pion xs + xillver + zxipcf*(relxillD))



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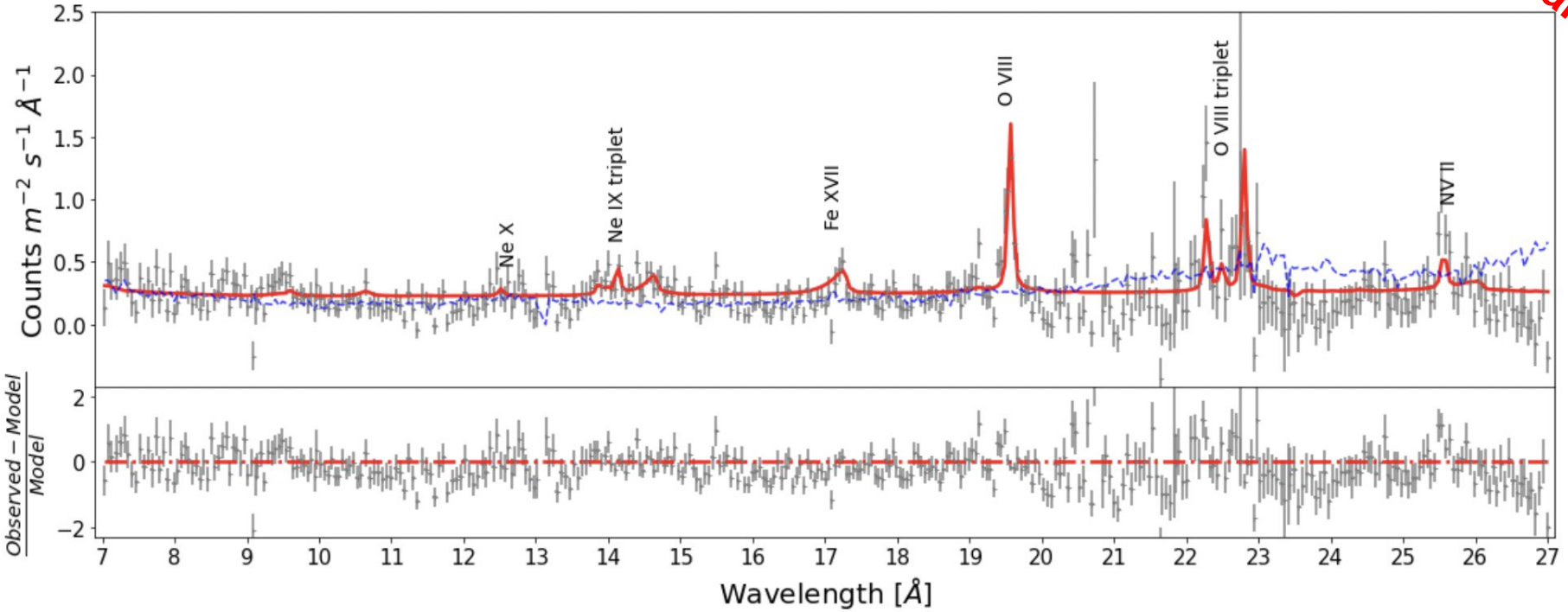
Observation 1 (Dec 2020)

preliminary

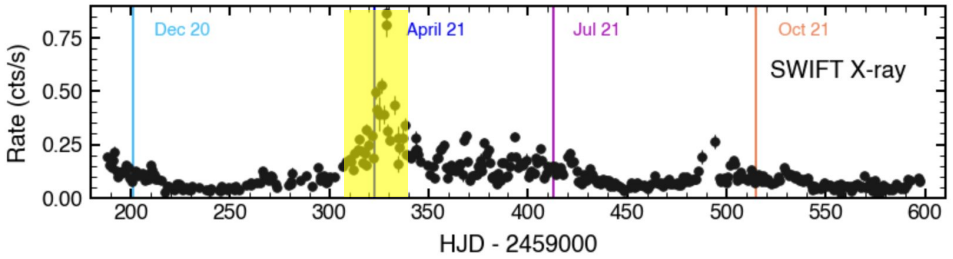


v ~ -300 km/s

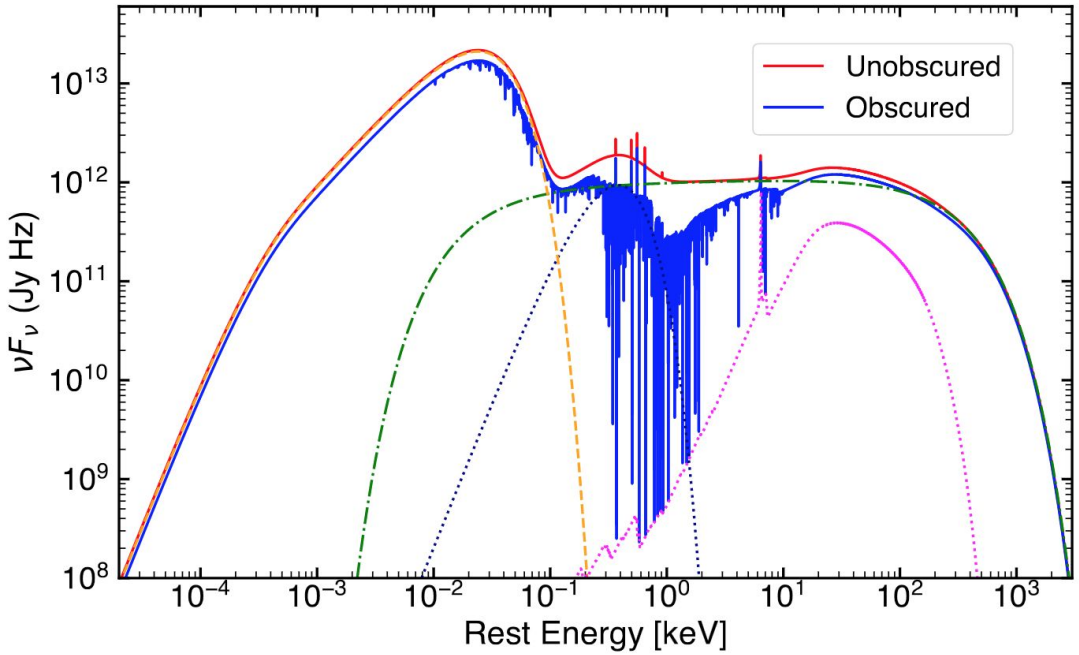
Original analysis by Jelle Kaastra & others

1655/1119 = 1.47

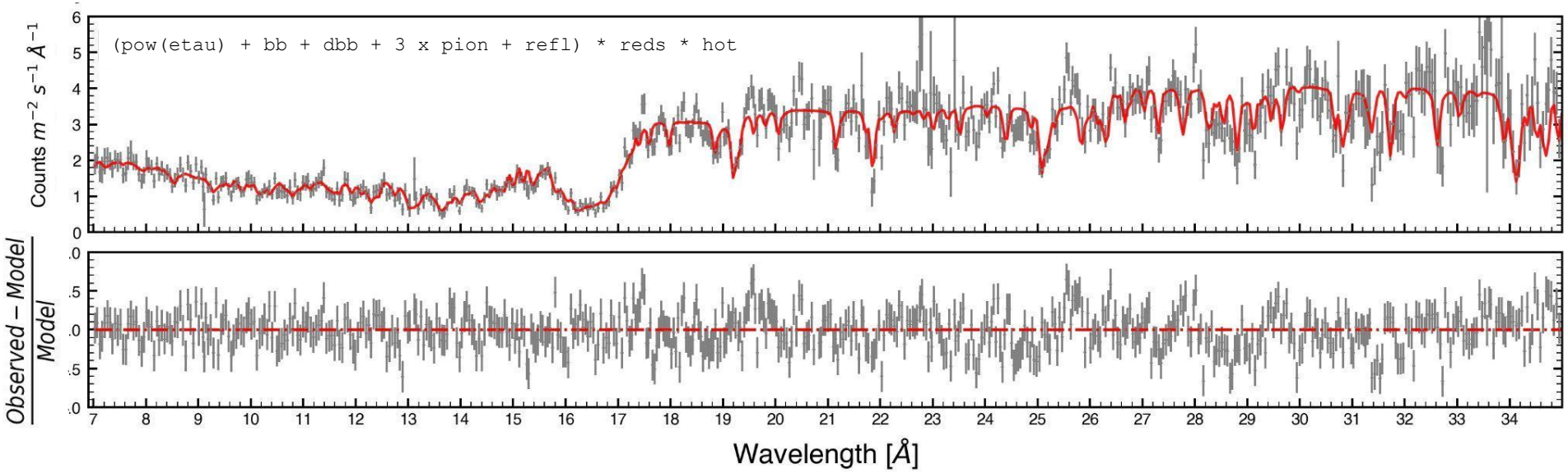
Modeling the Spectral Energy Distribution (April 2021)




```
(pow(etau) + bb + dbb +
 3 x pion + refl) * reds
* hot
```



RGS data final fit (April 2021)



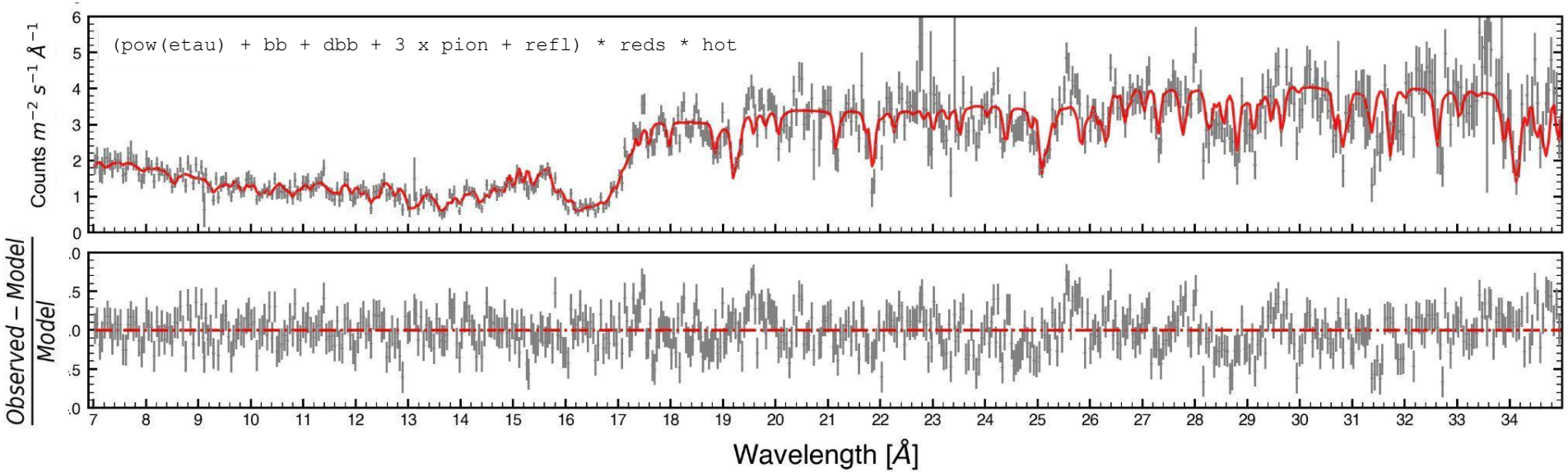
- 3 photoionization models are needed to describe the obscuring outflow → multiphase outflow

$\log \xi$ ~ 2.2 - 3.8 (10e-9 Wm)

N_{H} ~ 1 - 70 (10e21/cm^2)

v_{out} ~ 4100 - 6200 (km/s)

RGS data final fit (April 2021)

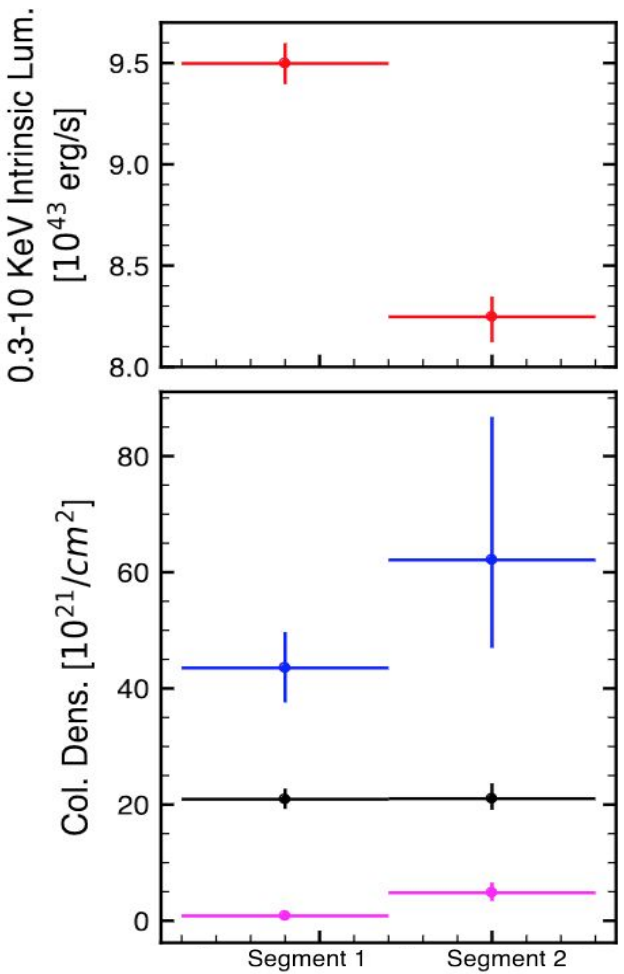


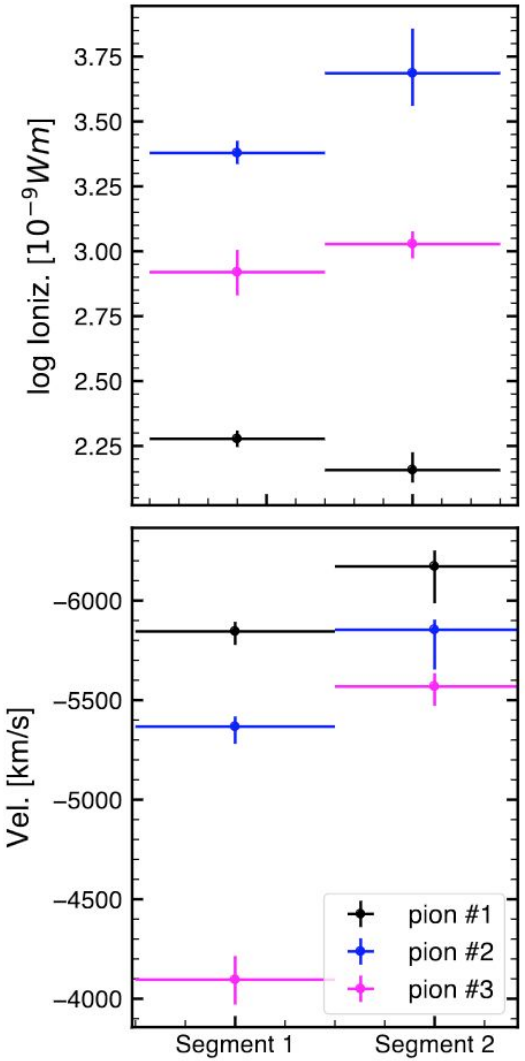
- 3 photoionization models are needed to describe the obscuring outflow → multiphase outflow
- The obscurer has a blueshift velocity of ~6000 km/s.

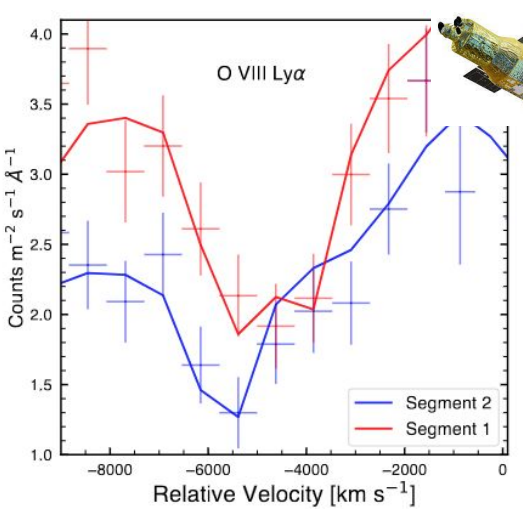
$\log \xi$ ~ 2.2 - 3.8 (10e-9 Wm)

$N_{\rm H}$ ~ 1 - 70 (10e21/cm^2)

$v_{\rm out}$ ~ 4100 - 6200 (km/s)

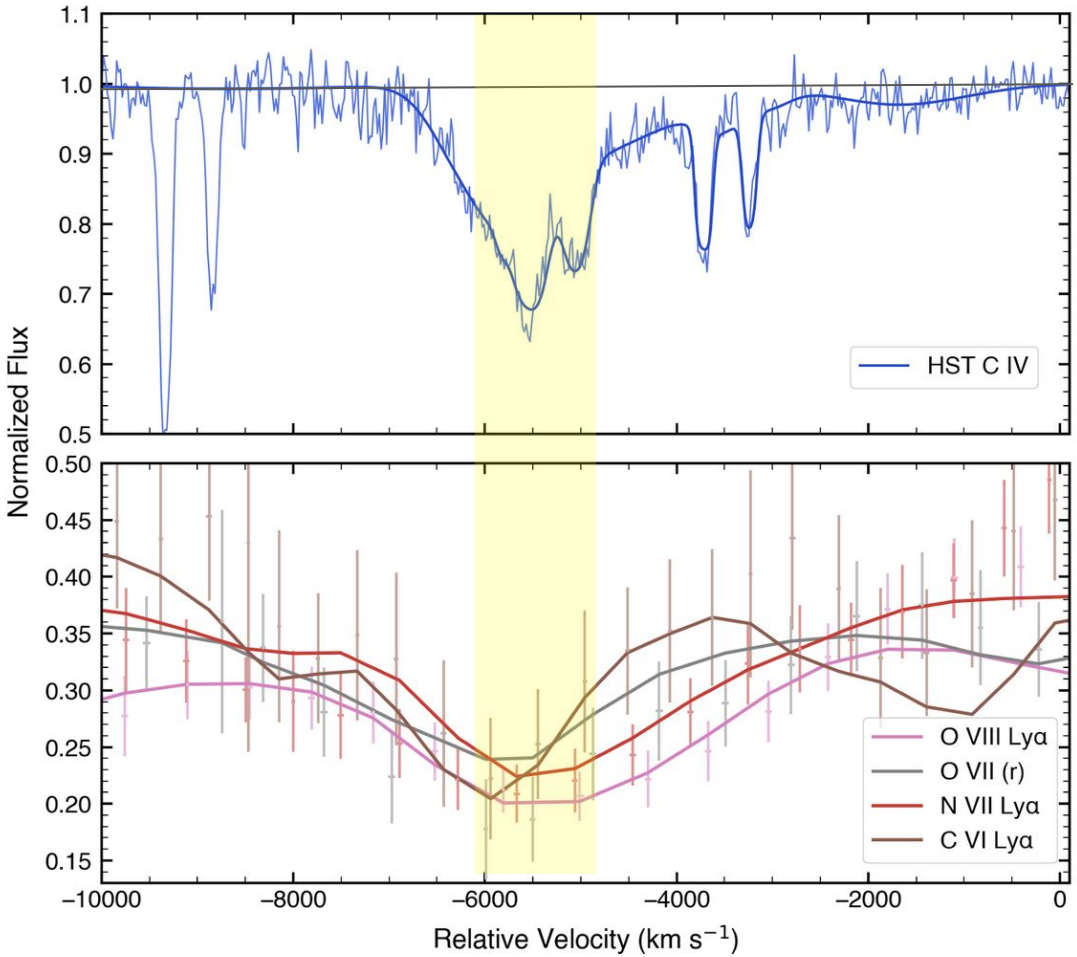






- A complex and clumpy flow that varies over the short observation time
- The ionized obscurer is a sub-pc distance away from the central black hole.

Velocity resolved absorption profiles

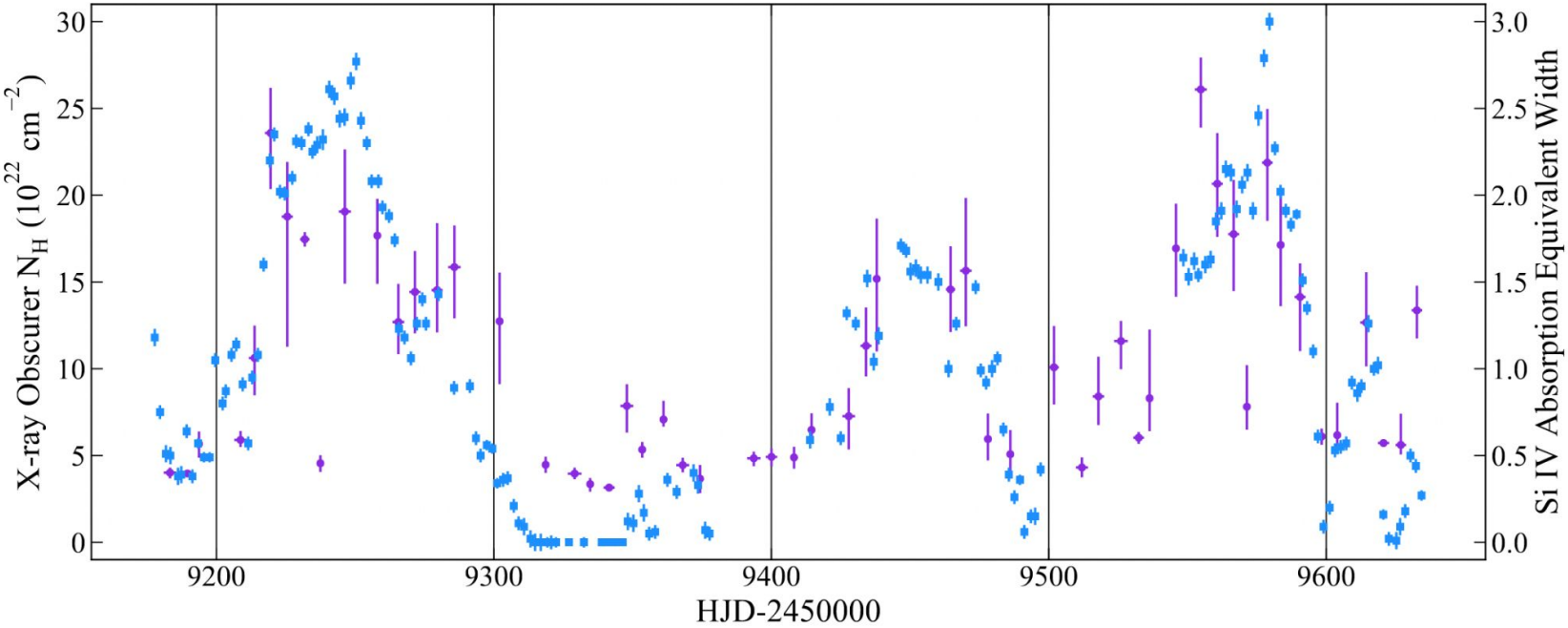


from UV HST C IV spectra

Credits: Jerry Kriss

from X-ray RGS spectra

Connection to the UV Obscurer



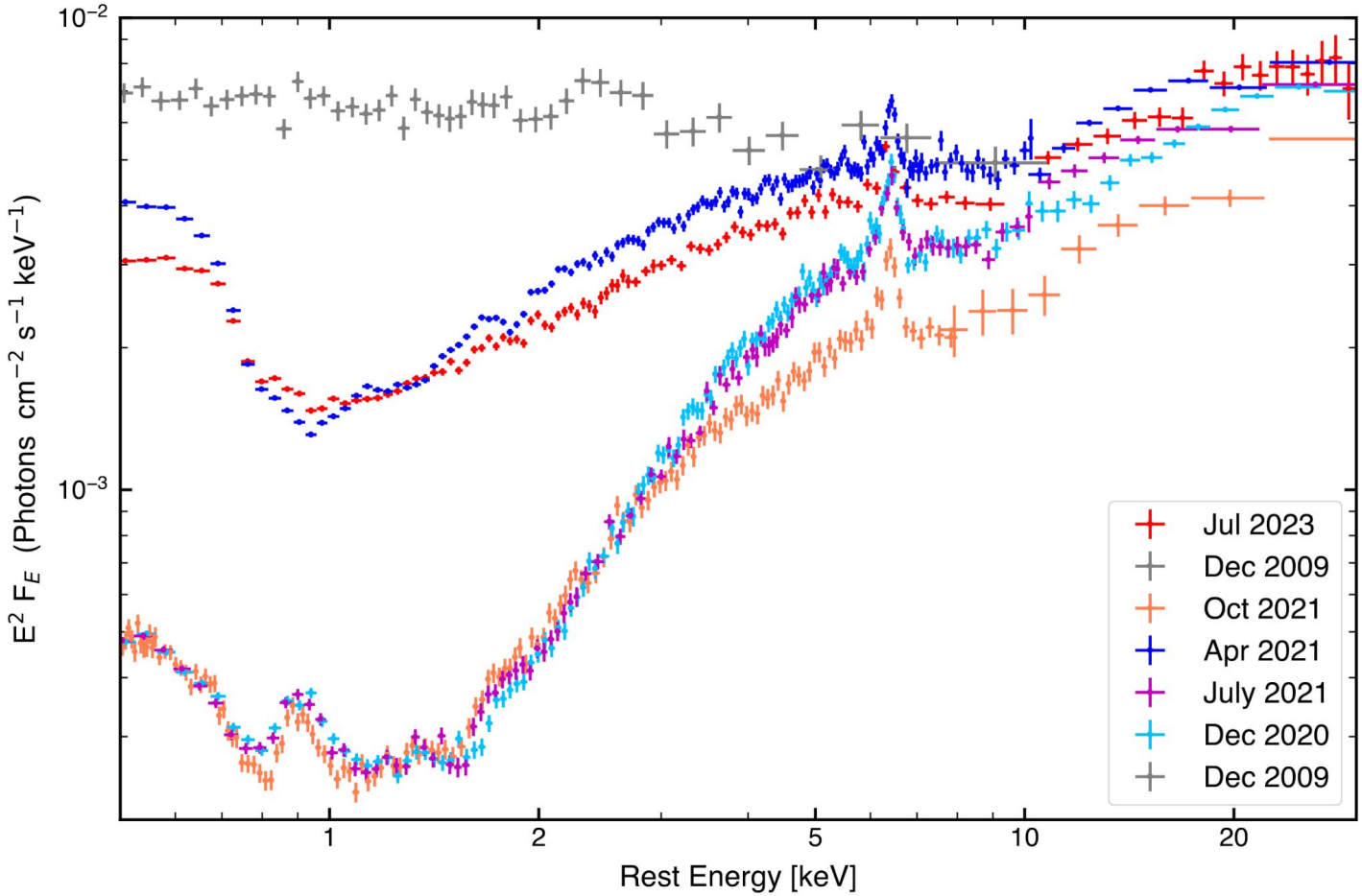
Partington et al. 2023

Purple : X-rays (NICER)
Blue : UV (HST)

The Equivalent Width of the Si IV absorption troughs (UV) correlate with the column density of the obscurer (X-ray)

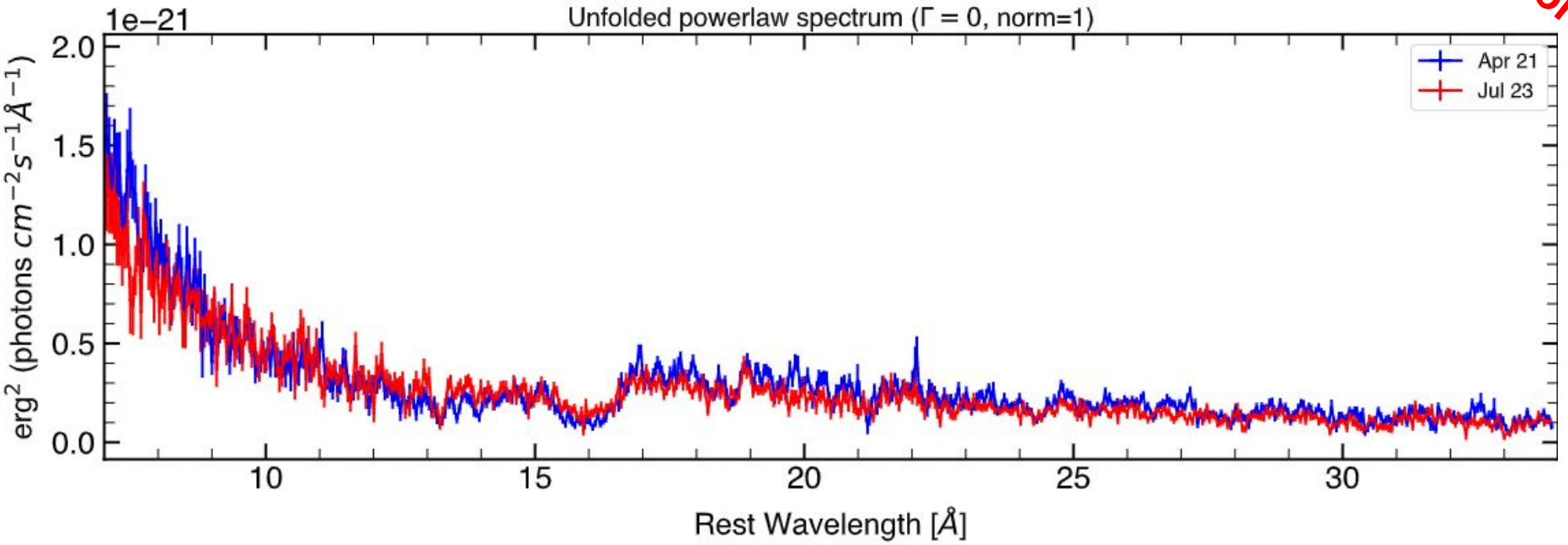
New observation from July : XMM PN + NuSTAR

Future Work



New observation from July : RGS

Future Work



Kara et al. 2021
Y. Homayouni et al. 2023
E. Partington et al. 2023
Cackett et al. in prep
Zaidouni et al. in prep
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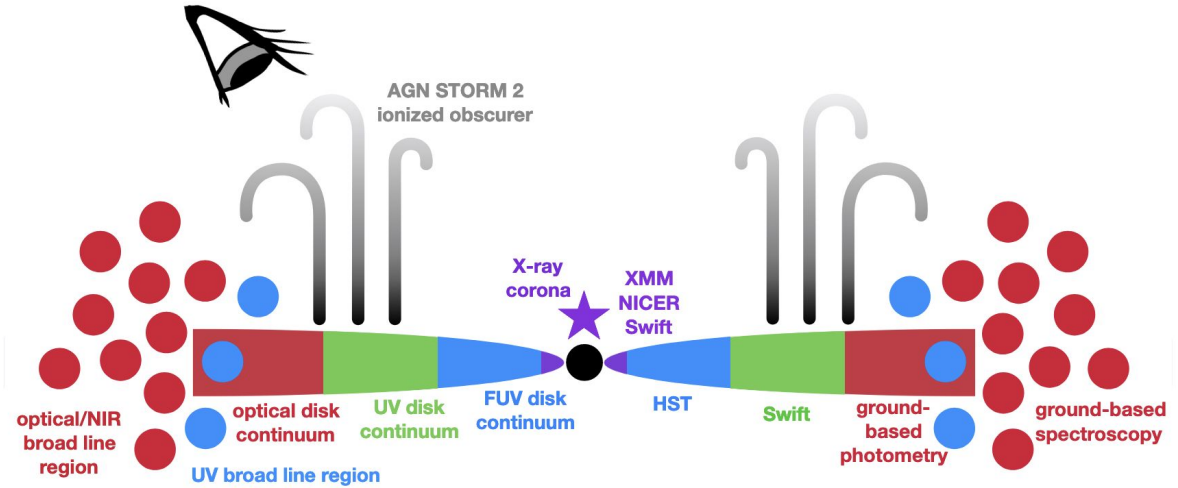

Kara et al. 2021