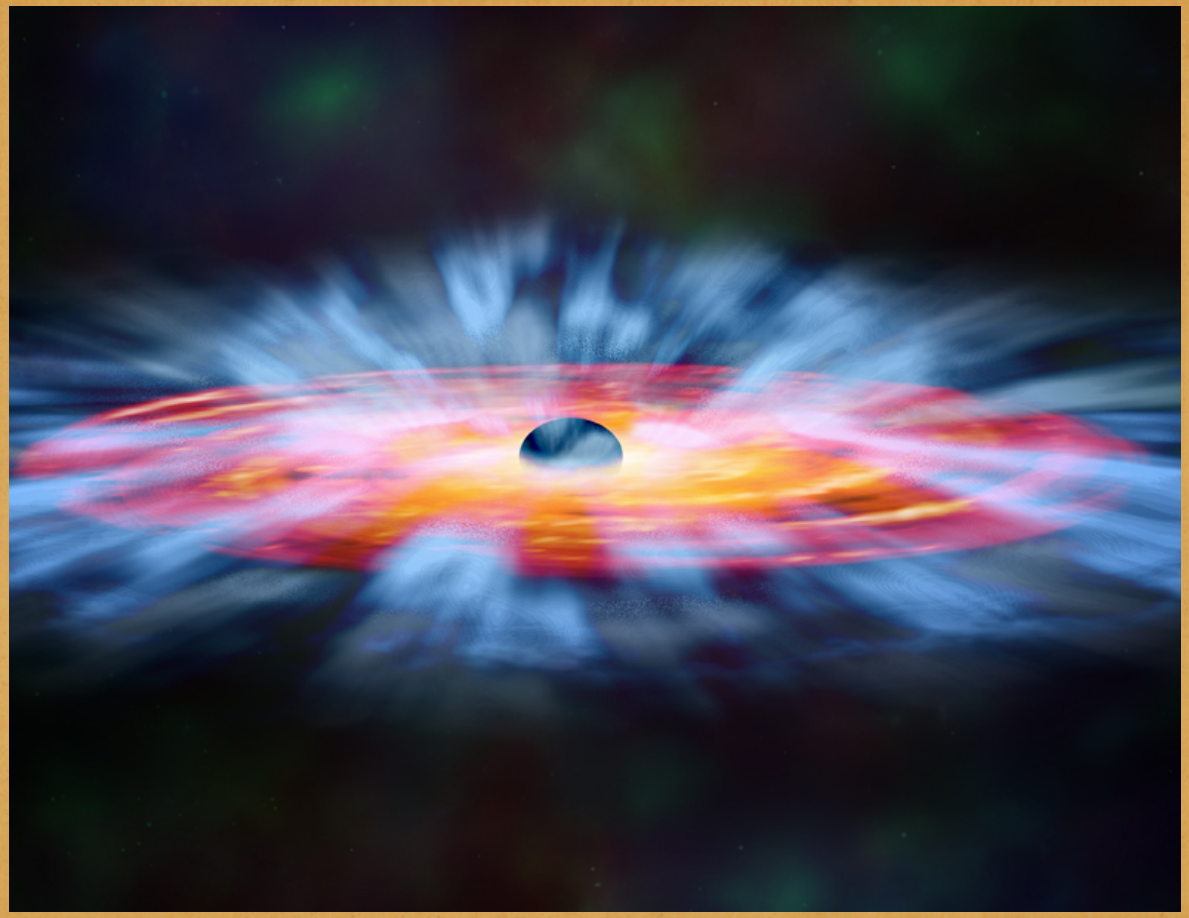
NGC 5548
The Lean Years



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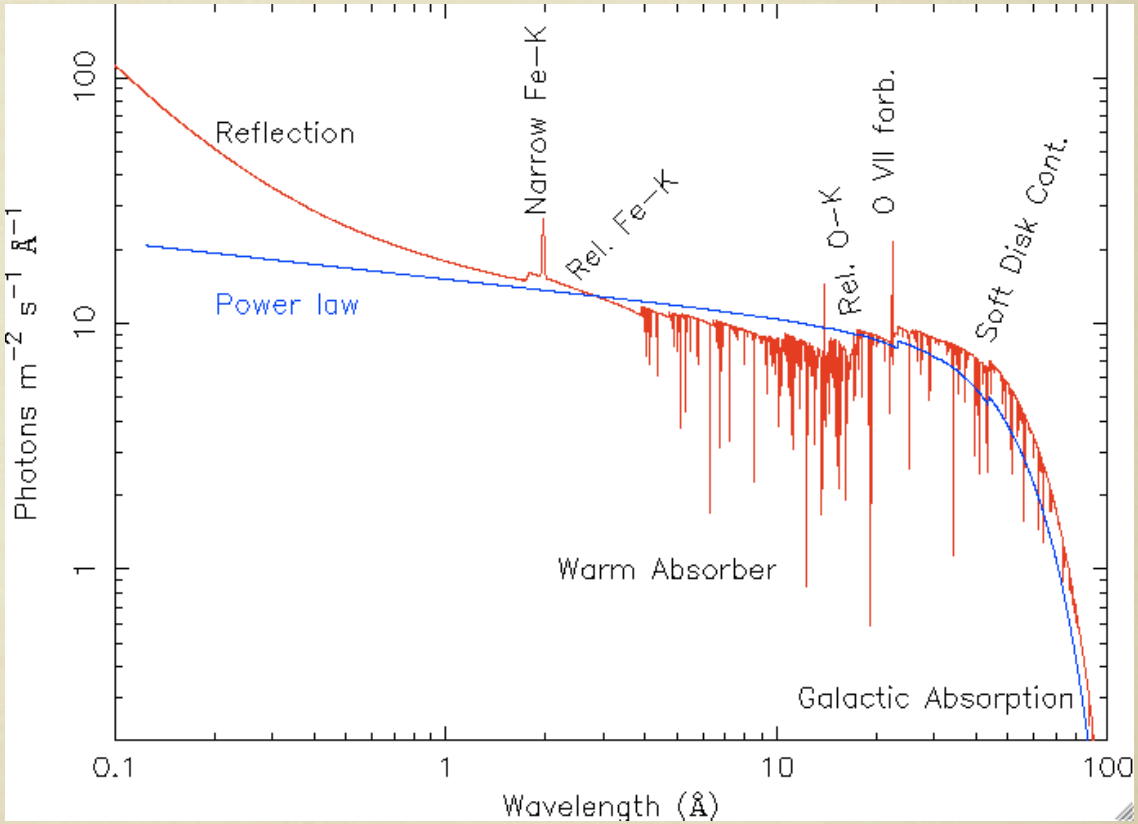
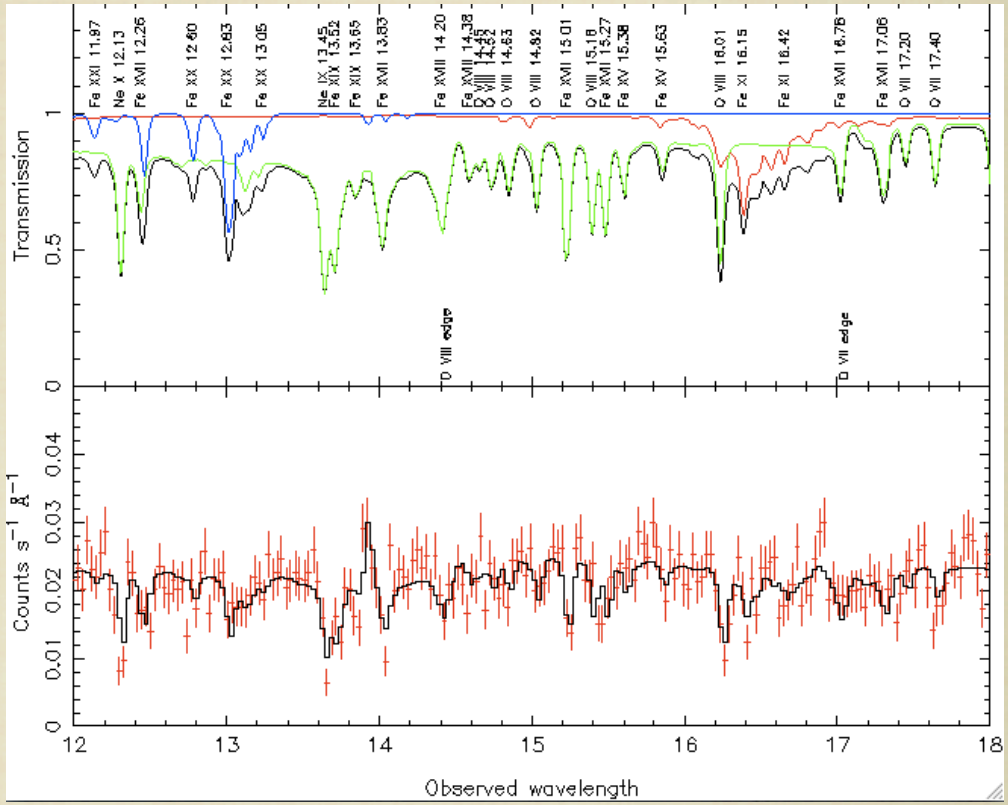
AGN X-ray Spectroscopy

- Accretion & Outflows.
- Connection absorber & other components.
- Velocity broadening of emission lines --> location gas.
- Ionisation of warm absorber --> physical state gas.



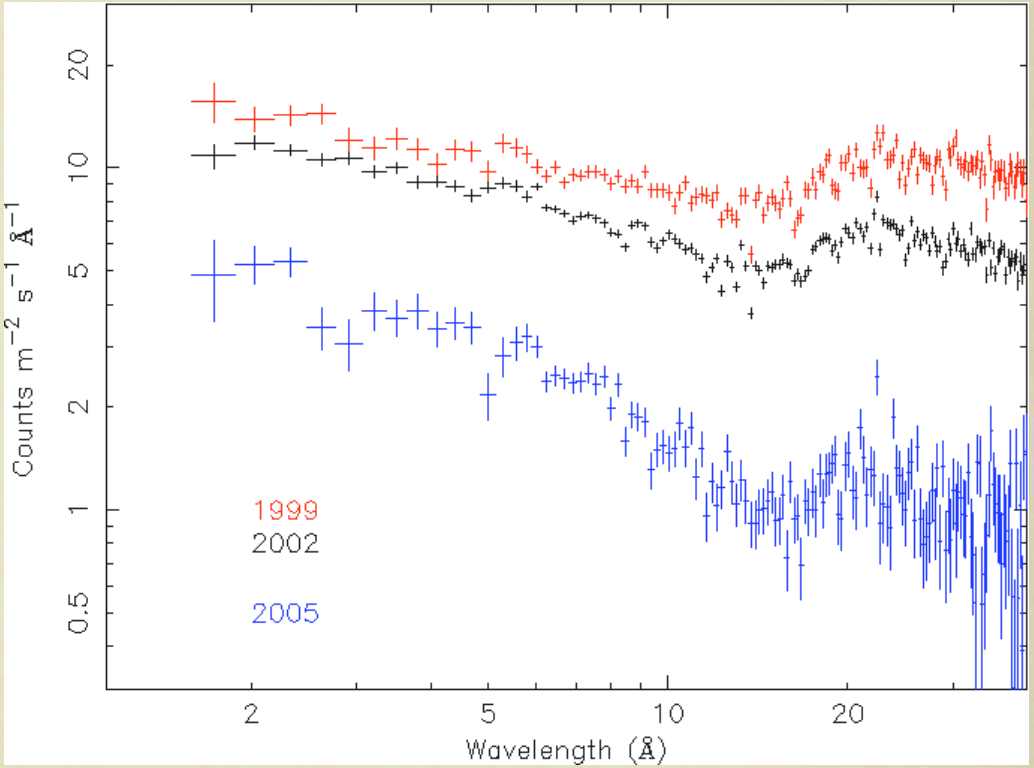
NGC 5548

- Very bright AGN, well studied X-ray + UV, low Galactic absorption.
- Earlier work (Kaastra et al. '02) --> multiple components.
- New Observation taken in april '05 with LETGS.
- How do components respond to change in flux?



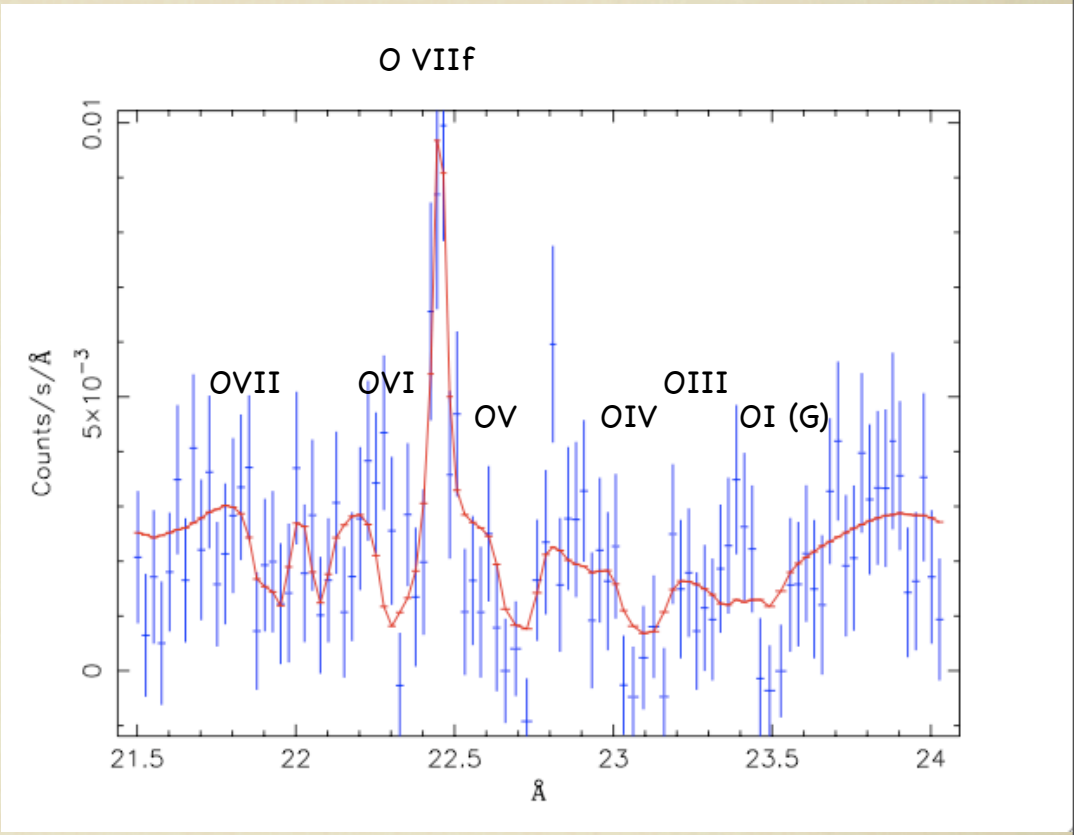
The year 2005

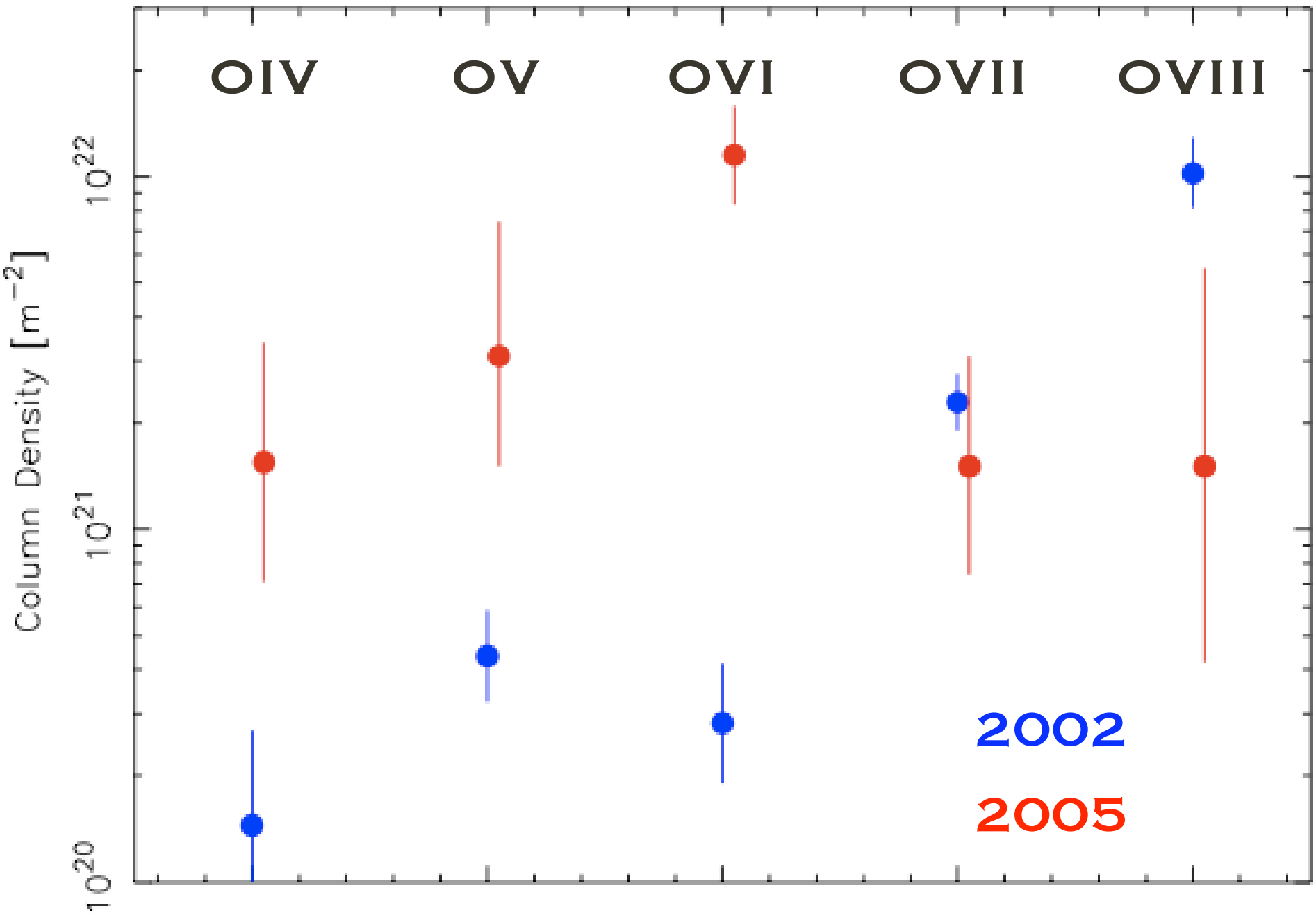
- Source very low state for long time (SWIFT & Optical) --> flux 5 times lower than 2002.
- Expect recombination in absorber + drop in line flux.

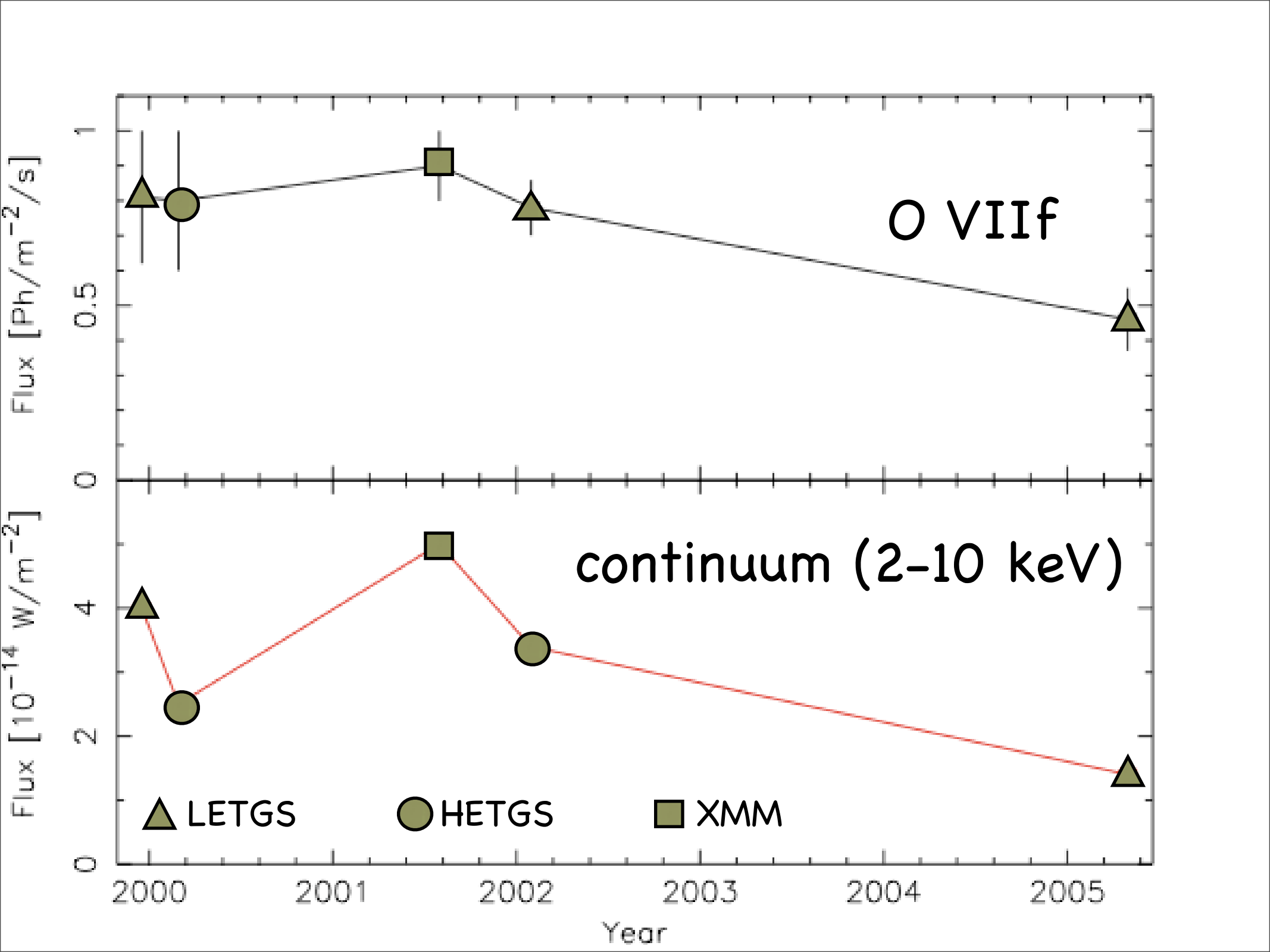


The year 2005

- Spline continuum: no a priori assumptions about continuum.
- Slab absorber (adjustable ionic column densities: for each ion all lines are fitted).
- Emission lines.




OIV
OV
OVI
OVII
OVIII
Column Density [m^{-2}]
10^{22}
10^{21}
10^{20}
2002
2005


O VIIf
continuum (2-10 keV)
Flux [Ph/m^{-2}/s]
Flux [10^{-14} W/m^{-2}]
0
0.5
1
0
2
4
LETGS
HETGS
XMM
2000
2001
2002
2003
2004
2005
Year

Location warm absorber

- $n \propto t_{rec}^{-1}$: $t_{rec} < 3$ years

  implies $n > 1.9 \times 10^{8}$ m^{-3}.

- $\log \xi = 1.65$, $L = 1 \times 10^{37}$ W (in 2002).

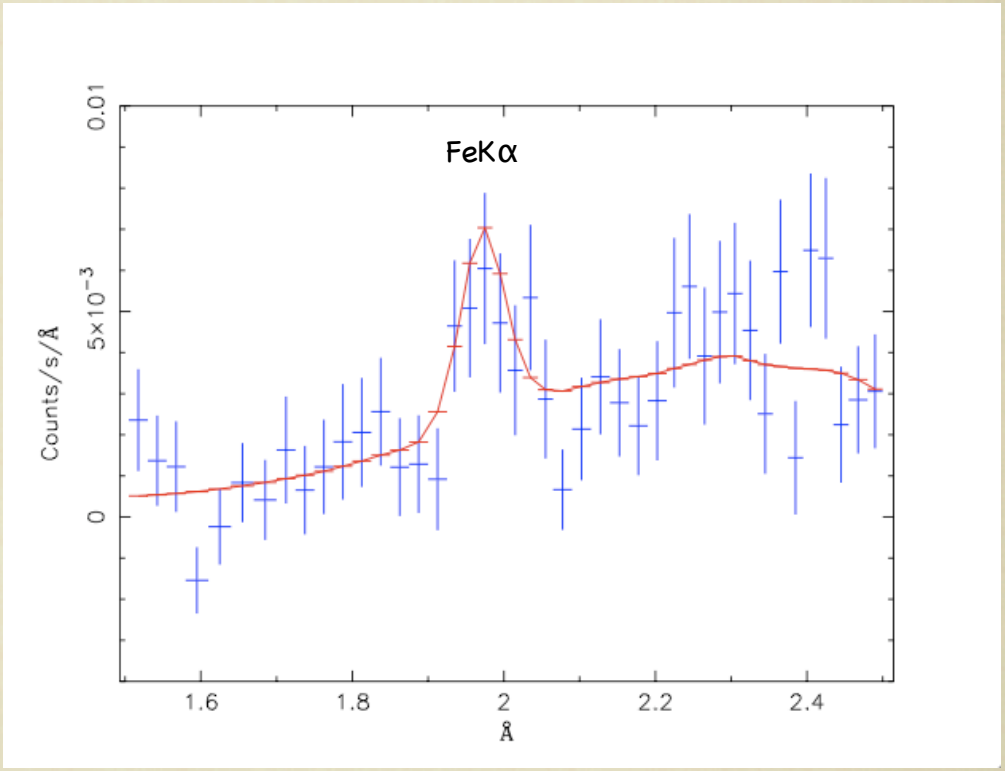
- $\xi = L / (n \times r^2)$: $r < 35$ pc.

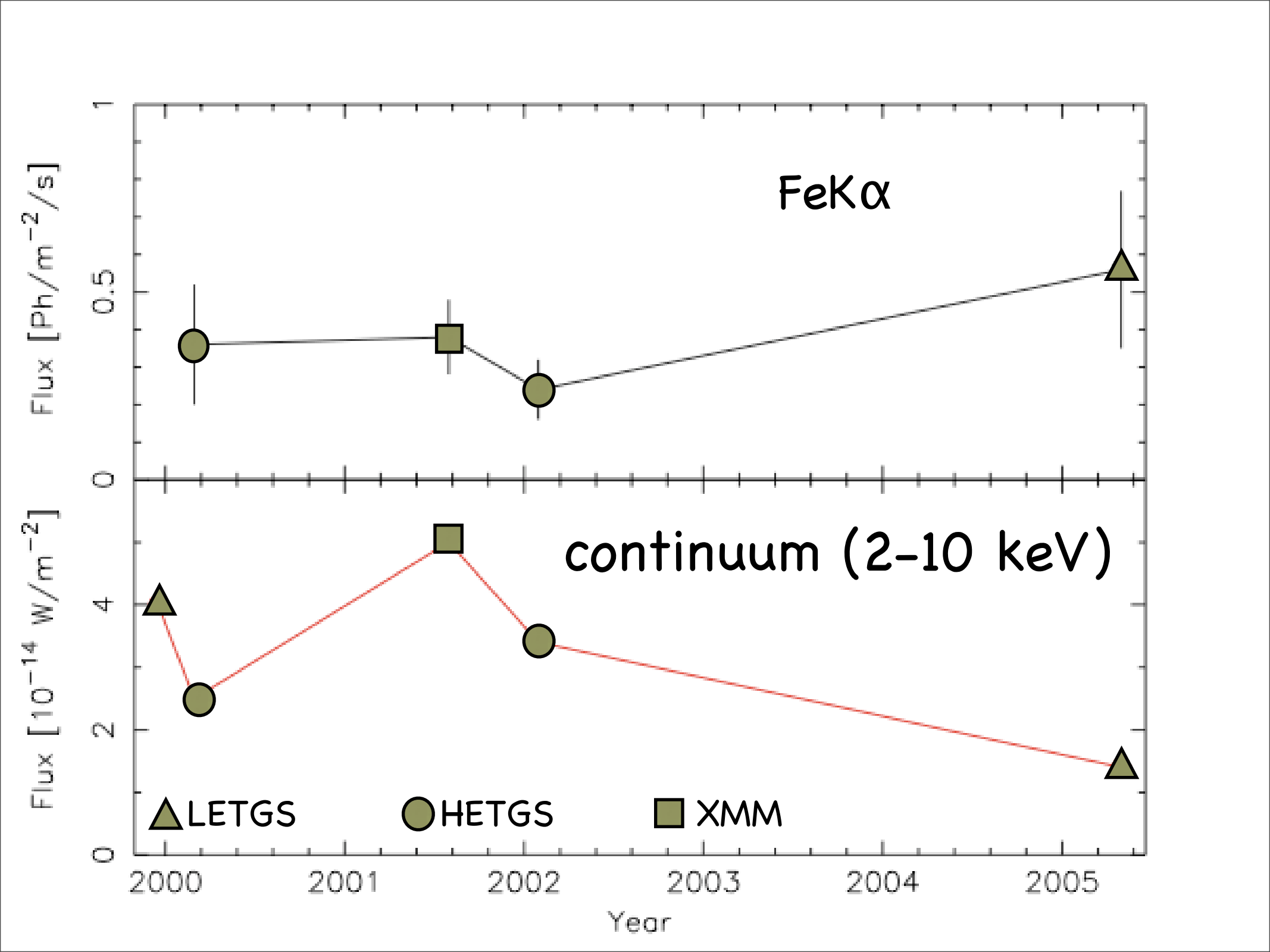
Location O VIIf emission gas

- Line response to change in flux within 3 years --> r < 1 pc.
- FWHM of line < 310 km/s--> r < 6 pc (Kaastra et al. '02).

The Iron Line

- Iron Fe Kα line at 6.4 keV --> detected due to low continuum.
- FWHM = 7300±2600 km/s suggests location close to central source: r < 0.03 pc.




FeKα
continuum (2-10 keV)
Flux [Ph/m^{-2}/s]
Flux [10^{-14} W/m^{-2}]
0
0.5
1
2
4
LETGS
HETGS
XMM
2000
2001
2002
2003
2004
2005
Year

Conclusions

- Gas in warm absorber reacts to lower flux by recombining --> r < 35 pc.
- Gas emitting O VIIf reacts to lower flux --> < 1 pc.
- Surprise: Gas emitting Fe-K does not change.

Observations Used

- 1999 Chandra LETGS (Kaastra et al. '02).
- 2000 Chandra HETGS (Yaqoob et al. '01).
- 2001 XMM EPIC (Pounds et al. '03).
- 2001 XMM RGS (Steenbrugge et al. '03).
- 2002 Chandra LETGS/HETGS (Steenbrugge et al. '05).
- 2005 Chandra LETGS this research (Detmers et al. in prep).