

A close look into the warm absorber in Mrk 509

A 180 ks *Chandra* LETGS observation

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Abstract

We present here the preliminary results of a 180 ks observation with *Chandra* LETGS of the luminous Seyfert 1 galaxy Mrk 509, which is part of an extensive multiwavelength observation campaign. The soft X-ray spectrum of Mrk 509 shows great complexity. Several absorption features are unmistakably signatures of the presence of a warm absorber with, at least, two distinct ionisation states. The lines of one component are blueshifted with respect to the systemic velocity, thus revealing the presence of outflowing gas at velocities of a few hundreds of km/s. The lines of the other component are likely to be consistent with the systemic velocity. In addition to this, there are at least three broad emission lines belonging to the unresolved OVII triplet and the CVI and NVII Ly-alpha transitions. Their *rms* velocities suggest that they do not originate in any phase of the warm absorber but, most likely, in the broad line region (BLR) of the AGN.

Fit to the data

- The continuum is modeled with a power-law + modified black body
- Broad gaussian lines were fitted to the OVII triplet lines, CVI and NVII
- The *rms* velocity of the broad lines is ~ 4000 km/s, consistent with an origin in the BLR
- Warm absorbers were fitted to two *xabs* model in SPEX
- One component clearly shows an outflow velocity of ~ 150 km/s, while the second one is probably consistent with the systemic velocity
- The model may still require further components as some of the lines, although detected, are not entirely fitted

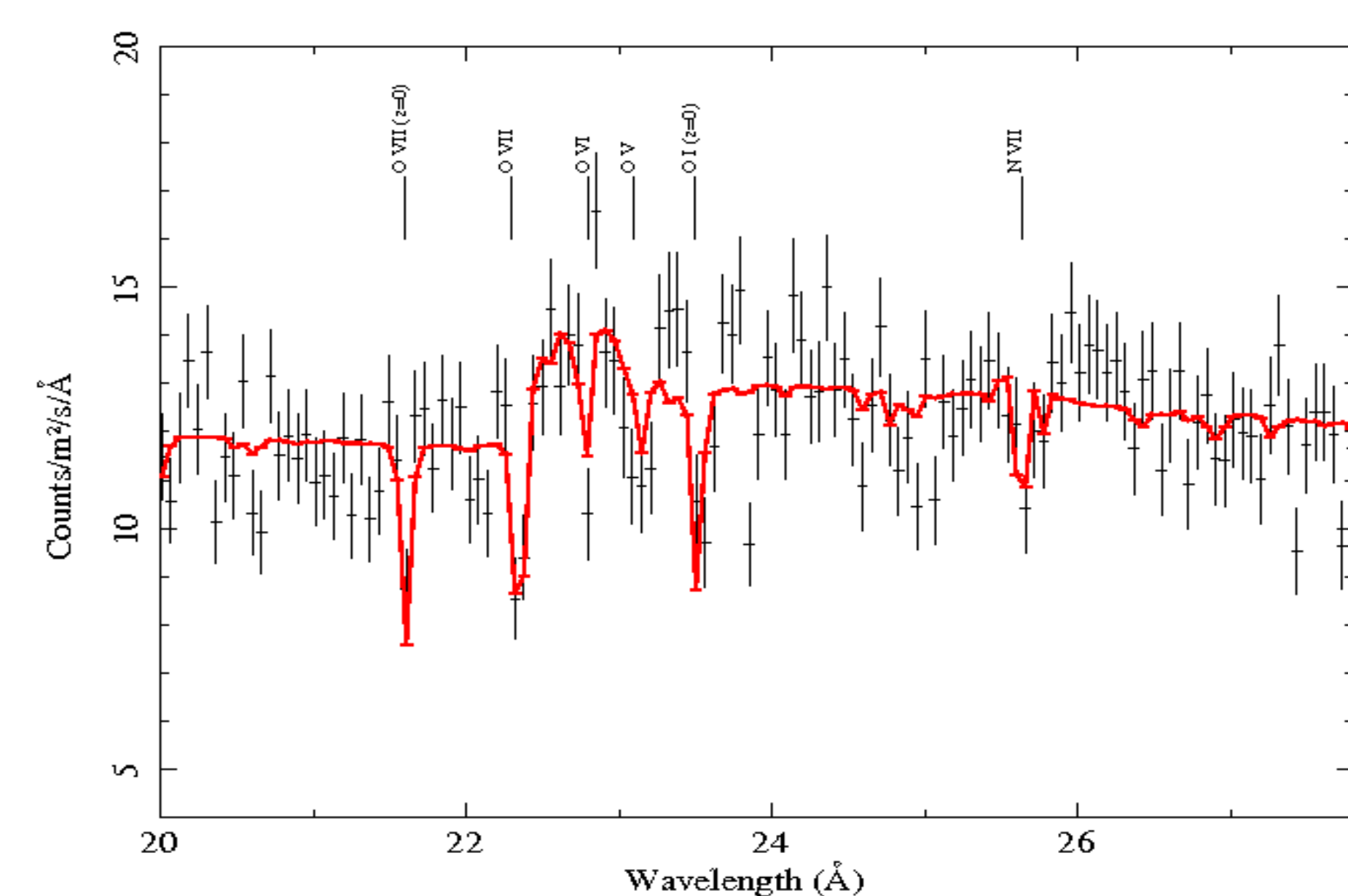
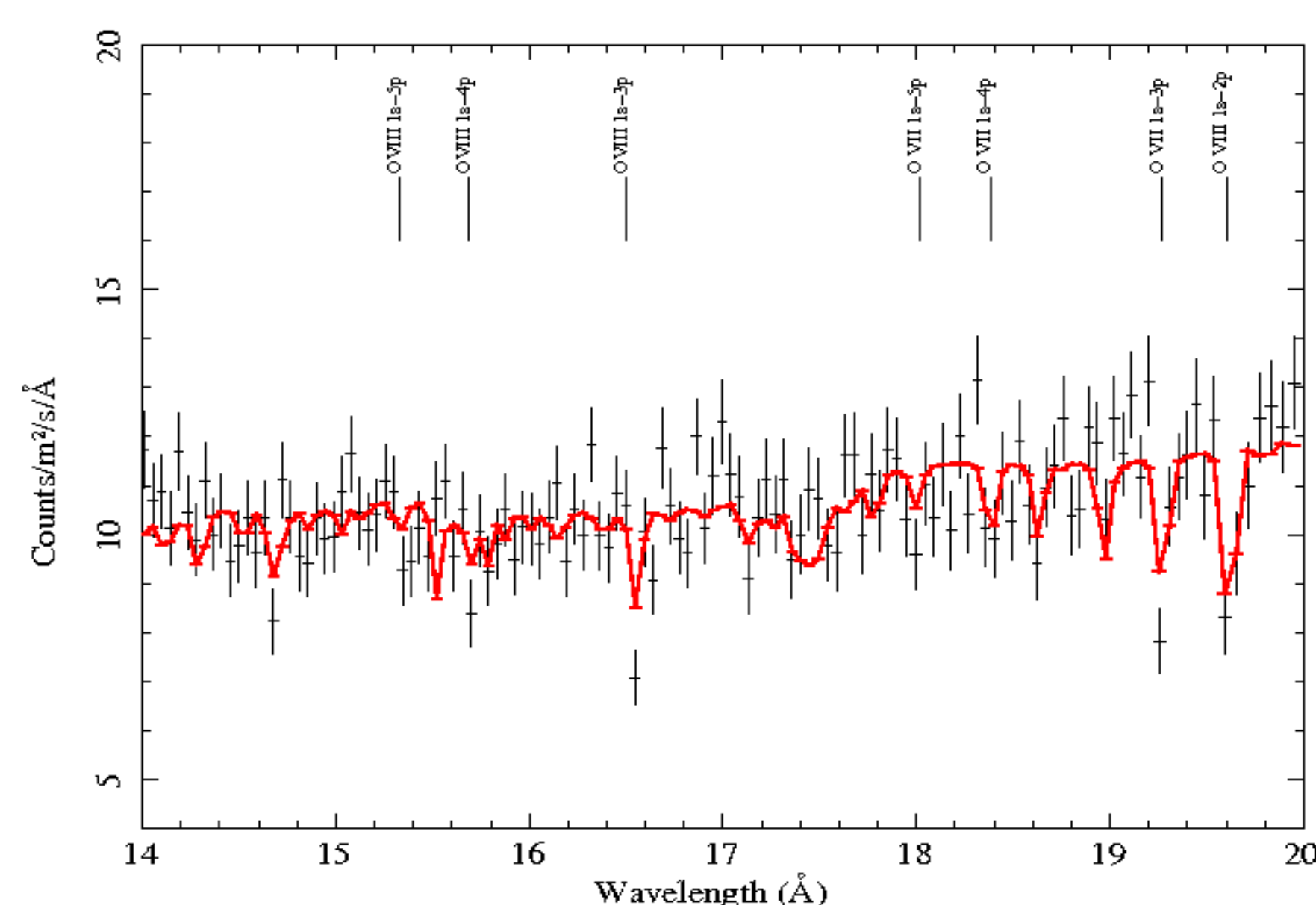
Best-fit parameters

Continuum (power-law + modified black body)

Γ	$L_{0.2-10}$ (erg/s)	T_{mbb} (keV)	L_{mbb} (erg/s)
2.16 ± 0.04	$2.38 \pm 0.05 \times 10^{44}$	0.121 ± 0.007	$3.76 \pm 0.52 \times 10^{43}$

Warm absorber

	WA1	WA2
$\log \xi$ (erg/s/cm ²)	0.91 ± 0.17	2.11 ± 0.06
N_{H} (cm ⁻²)	$2.0 \pm 0.6 \times 10^{20}$	$7.8 \pm 1.8 \times 10^{20}$
v_{out} (km/s)	168 ± 76	-141 ± 62
rms (km/s)	59 ± 16	53 ± 16



Conclusions and future work

This is the preliminary analysis of the 180 ks LETGS spectrum of Mrk 509. Strong WA signatures are detected in its soft X-ray spectrum coming from, at least, two ionisation states.

There are still several issues to address such a possible LETGS wavelength calibration uncertainties that may introduce systematic offsets in the position of the lines and affect the measured outflow velocities. Additionally, the complex spectrum may require more WA discrete components, or even a continuous distribution of ionisation states.

