SWIFT, XMM-NEWTON AND NuSTAR OBSERVATIONS OF MRK 915: A DEEP LOOK INTO THE X-RAY PROPERTIES

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The Seyfert 1.5-1.9 galaxy Mrk 915 (z=0.024) has been the target of an X-ray monitoring programme, spanning from 1 month down to few hours, carried out with *Swift*, XMM-*Newton* and NuSTAR.

Our *Swift*–XRT daily monitoring revealed the presence of a partial covering ionized and variable absorber.

<u>*The Swift monitoring*</u> 76 ksec observations spanning ~3 weeks.
Variations on a time-scale of few days are due to a change by a factor ~1.5 in the intrinsic emission + a change in the ionization ξ and/or in the covering factor of a partial covering (PC) ionized absorber.

(Severgnini et al. 2015, MNRAS, 453, 3611)

<u>*The XMM-Newton + NuSTAR monitoring*</u> 230 ksec with XMM-*Newton* + 150 ksec with NuSTAR splitted in 3 observations separated from each other by ~5 day.
The emission level is comparable with the low state observed by *Swift*-XRT *(Severgnini et al. 2015)*, see Fig. 1.

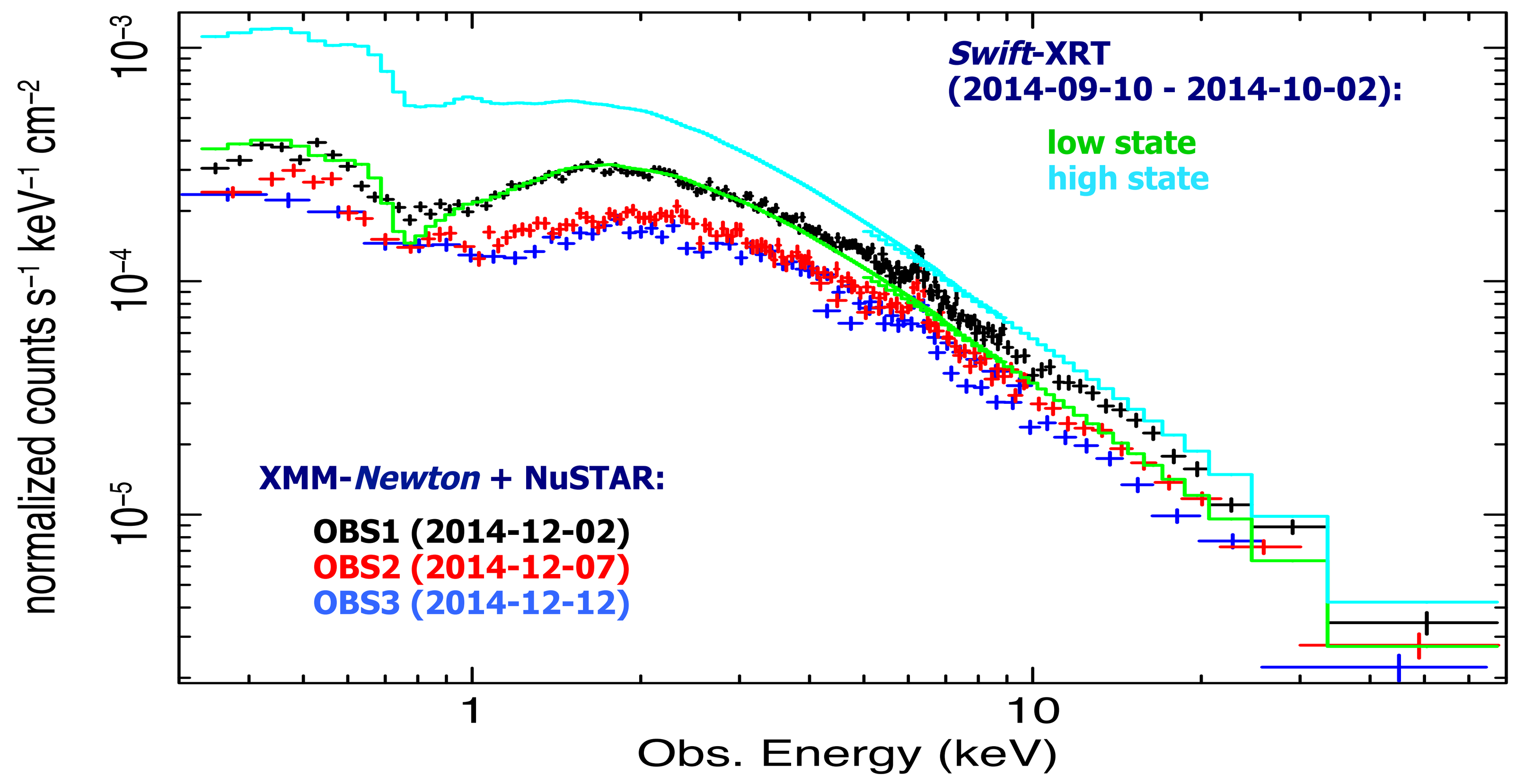
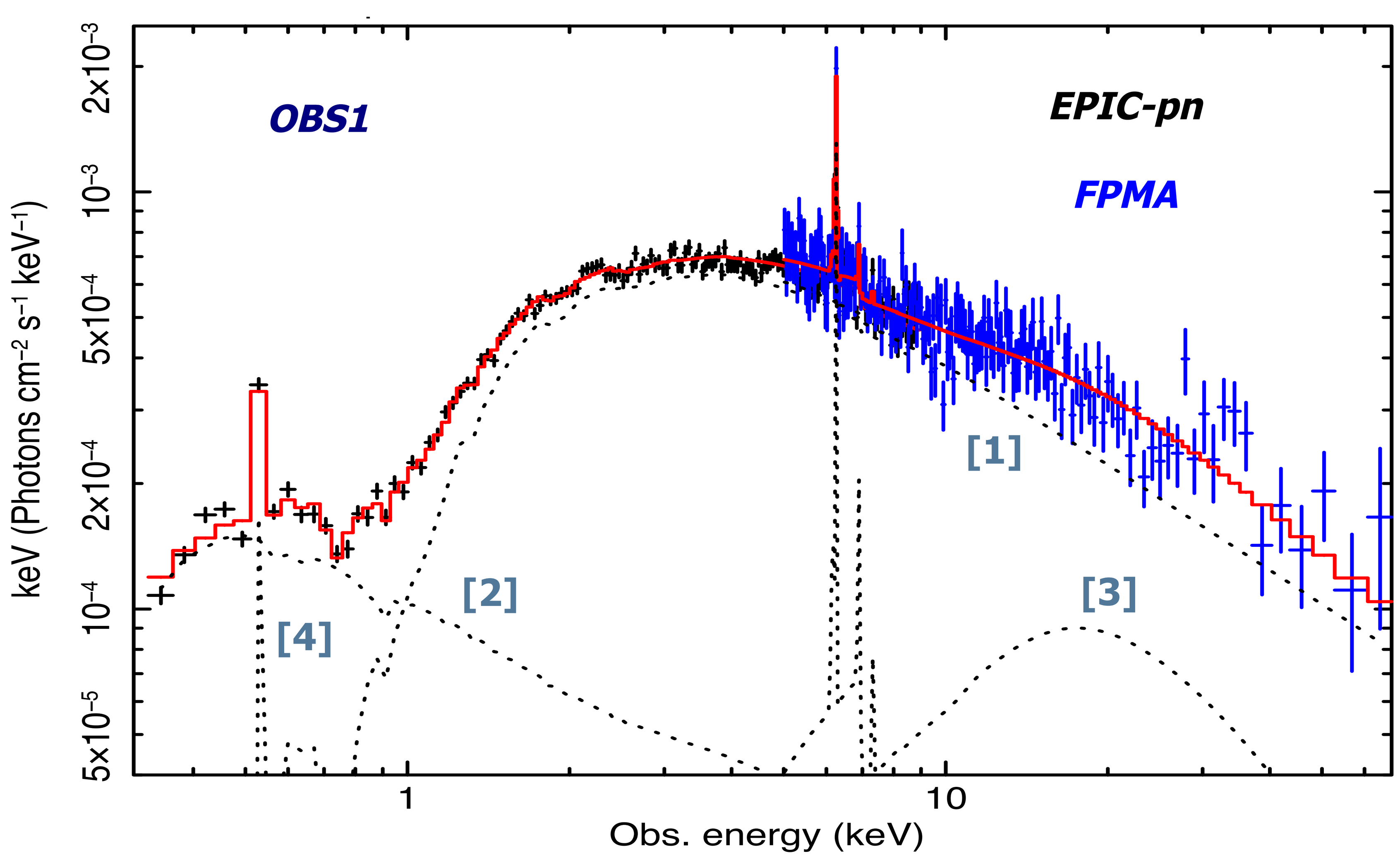


Fig. 1 XMM-*Newton* and NuSTAR spectra compared with the two emission states observed during the *Swift*-XRT monitoring.

The X-ray monitoring programme carried out jointly by XMM-*Newton* and NuSTAR reveals the presence of a two-phase warm absorber: a fully covering mildly ionized structure and a partial covering lower ionized one.

A high-column density distribution of neutral matter covering a small fraction of the central region is also observed.



<u>*RGS data*</u> The high-resolution spectra suggest the presence of a multi-layer partially ionized absorber. A few emission lines are also observed.

<u>*EPIC+FPMs spectra*</u> The data are described within an "absorption-based" scenario (see e.g. Fig. 2):

- ✧ an intrinsic power law with Γ~1.85;
- ✧ a two-phase warm absorber:
  - TC: log ξ/(ergs cm s^{-1}) ~ 2.3, N_H~1.3×10^{21} cm^{-2}, 100% covering;
  - PC: log ξ/(ergs cm s^{-1}) ~ 0.6, N_H~2×10^{22} cm^{-2}, 90% covering;
- ✧ a PC neutral absorber: N_H~1.5×10^{23} cm^{-2}, ~30% covering;
- ✧ cold reflection from distant matter, with reflection fraction $\mathcal{R}$~0.6.

(Ballo et al. MNRAS in press, arXiv:1705.11114)

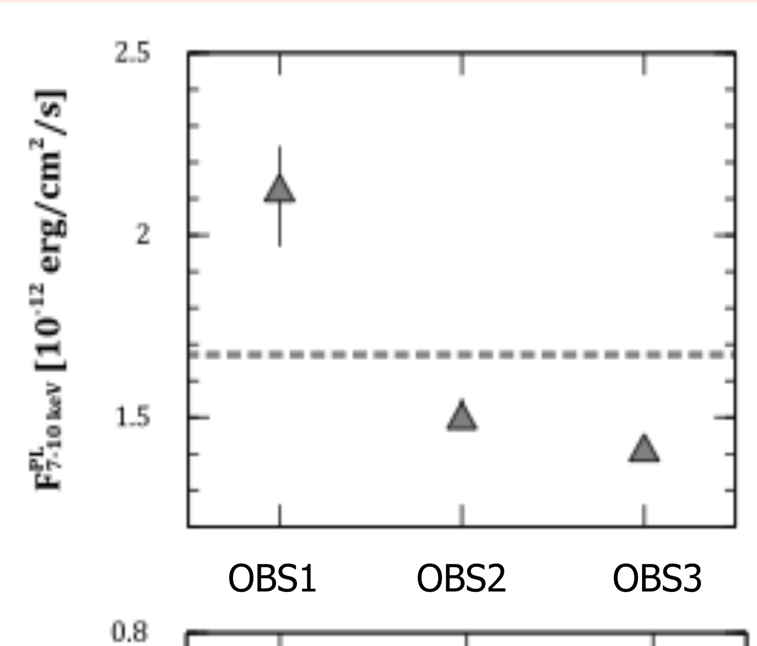
Fig. 2 Unfolded EPIC-pn and FPMA spectra, with the best-fit model applied (red line).
The adopted model is a power law seen through two ionized layers of material, one total covering and one partially covering ([1] and [2] identify the fraction of continuum covered and uncovered, respectively), plus reflection from distant material [3] and a narrow emission line [4]; the whole emission is absorbed by neutral material partially covering the central region.

We tentatively locate this complex absorber closer to the central source than the narrow line region, possibly in the broad line region, in the innermost part of the torus, or in between.

The neutral obscurer may either be part of this same stratified structure (as observed e.g. in NCG 5548; Kaastra et al. 2014, Science, 345, 64) or associated with the walls of the torus, grazed by (and partially intercepting) the line of sight.

<u>*Variability*</u> Variations are mainly due to a decreasing of the direct continuum by a factor of ~1.5. Slight variations in the PC ionized absorber are also detected; the data are consistent with no variation of the TC ionized absorber and the PC neutral absorber (see Fig. 3).

(Ballo et al. MNRAS in press, arXiv:1705.11114)



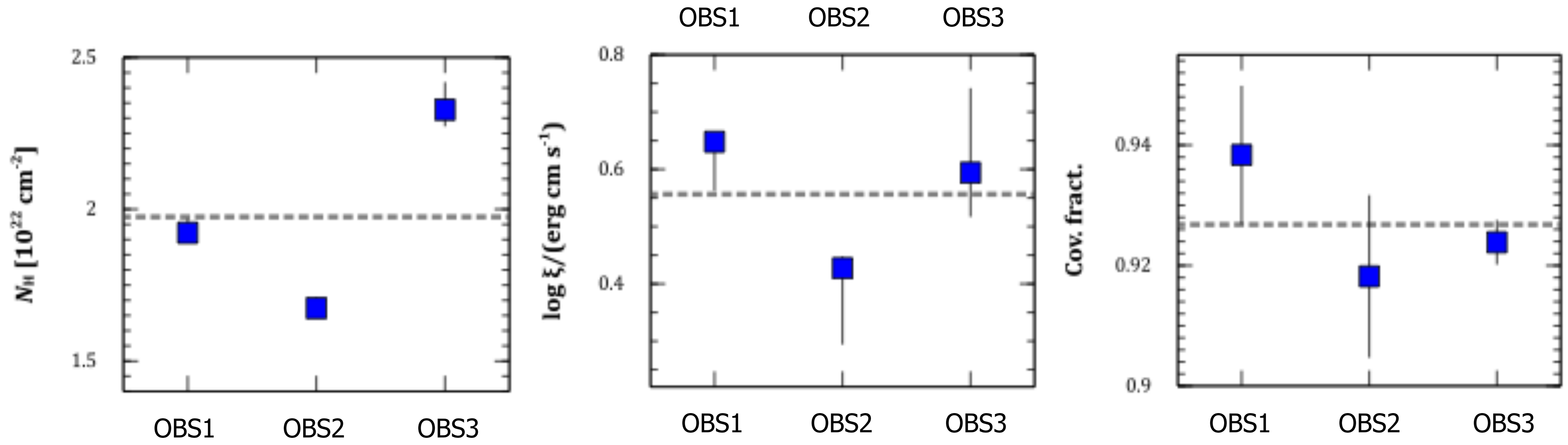


Fig. 3 Evolution of the spectral fit parameters observed to vary during the XMM-*Newton*+NuSTAR monitoring.
Grey triangles, decrease in the flux of the power law observed between 7 and 10 keV passing from OBS1 to OBS2 and OBS3.
Blue squares, from left to right: variations in the N_H, log ξ, and covering fraction of the PC warm absorber.
Dashed lines mark the mean value.