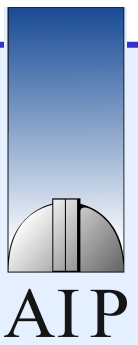


Chandra LETGS observation of the variable NLS1 galaxy Ark 564 I. Time average spectrum



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We present an analysis of a 100 ks X-ray spectrum of the Narrow-Line Seyfert 1 Galaxy Ark 564, which we have taken with the Low Energy Transmission Grating Spectrometer (LETGS) on board the X-ray telescope Chandra. We apply several spectral continuum models on the time-averaged X-ray spectrum of this object, and study the possible origin of the soft X-ray excess observed. In particular we find the use of relativistically blurred photoionized disc models, with $\xi \sim 2500$ (500) appropriate for the global (soft X-ray) description of the spectrum. We also characterize the average intrinsic absorption of the system, with the use of self-consistent photoionization modeling. The lack of the OVII He α in the spectrum leads us to conclude that there might be an outflow material moving at ~ 5500 km/s, one the fastest found in a Seyfert Galaxy, also observed in other Seyferts (e.g., NGC 4051).

Table 1. Fit results of continuum models of Ark 564						
Model	χ^2_{ν}	N^{H}	kT (eV)	N^{H}	Parameters	χ^2_{ν}
PL _{in} +BB	2.5 ^{+0.1}	10 ²¹	120 ± 1	3.1 ± 0.1		1063.52/441
PL _{in} +BB	2.87 ± 0.01	11.8 ± 0.2	139 ± 6	1.0 ± 0.2		684.06/439
PL _{in} +2BB	2.5 ^{+0.1}	10 ²¹	132 ⁺²	2.5 ± 0.1	kT_1 (eV) N^{H}_1 kT_2 (eV) N^{H}_2	39 ± 2 9.9 ± 3.0
PL _{in} +PL _{edge}	1.1(1)	N(1) [†]	1.1(2)	N(2) [†]		1177.23/441
PL _{in} +PL _{edge}	1.1(3)	N(1) [†]	1.1(2)	N(2) [†]		864.79/439
PL _{in} +Ed	2.88 ± 0.01	13.7 ± 0.1	1.26 ± 0.01	0.25 ± 0.03		739.41/439
PL _{in} +Ed	2.79 ± 0.01	13.9 ± 0.1	1.27 ± 0.01	0.22 ^{+0.03}	E_{edge} (keV) τ_1 E_{edge} (keV) τ_2	1.07 ± 0.01 0.12 ± 0.03
PL _{in} +Cor	2.89 ± 0.01	20 ⁺¹	9 ⁺¹	0.36 ± 0.12		856.21/439
PL _{in} +2Cor	2.89 ± 0.01	20 ⁺¹	9 ⁺¹	0.36 ± 0.12	f_1 f_2	856.42/437
PL _{in} +BB+Cor	3.15 ^{+0.1}	28 ± 5	175 ± 6	6.9 ^{+1.1}	$N^{\text{H}}_{\text{cor}}$ f	615/437
PL _{in} +2BB+Cor	2.79 ± 0.09	15 ± 1	129 ⁺¹	20 ⁺¹	kT_1 (eV) N^{H}_1 kT_2 (eV) N^{H}_2 $N^{\text{H}}_{\text{cor}}$ f	568.23/435

Table 1: Several continuum models have been applied to the 0.1-10 keV LETGS spectrum of Ark 564.

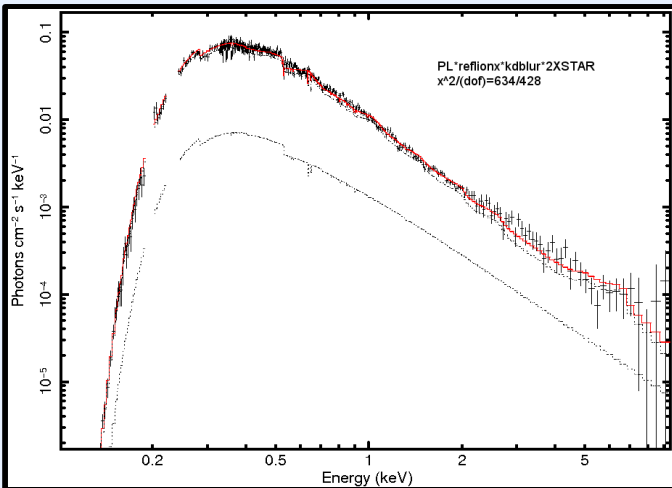


Fig 1: The final global solution, in favor of a physical model is the relativistically blurred photoionized disc model. Which consists of a reflection component convolved by a Laor profile.

The XSTAR photoionization code is used to produce the narrow features seen in the spectrum. In particular the lack of the OVII He α line at 21.60 Å lead us to conclude about the possibility of being observing an outflow at velocities of $v \sim 5500$ km/s. Or a variation in the line strength not well studied yet. The results can be understood within the context of the relation between ξ and v :

$$\xi = \left(\frac{4\pi\mu m_H L f}{\dot{M}} \right) v$$

for spherical winds, where \dot{M} is the mass outflow rate of the system. Such relation is still under investigation.

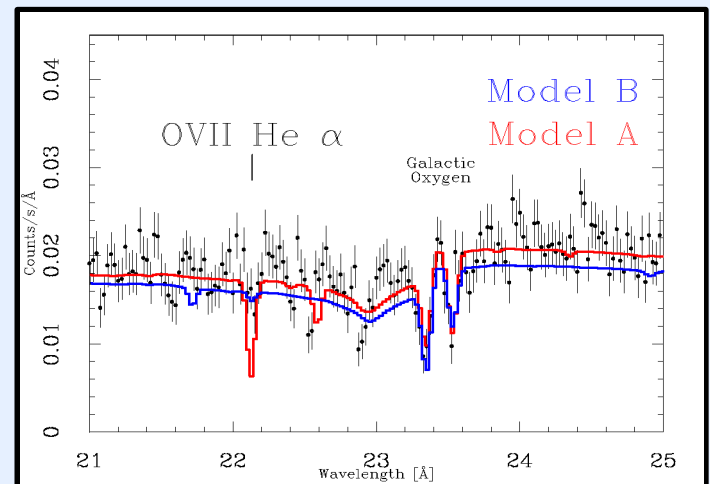
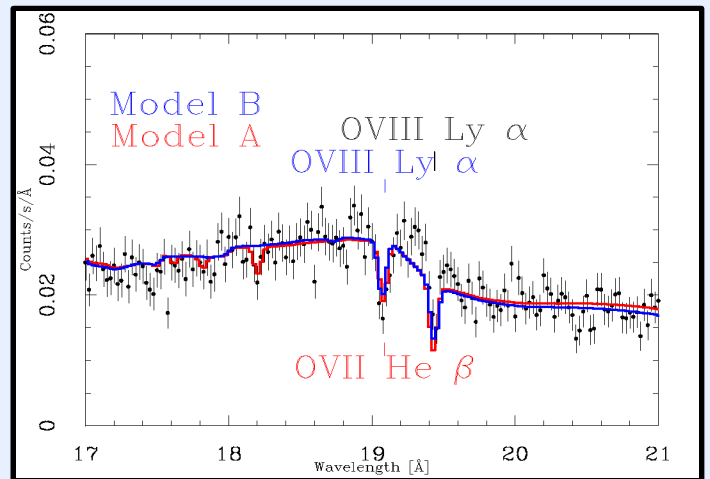


Fig 2: 17-25 Å LETGS band of Ark 564. Model A is composed for a (PL + 2BB)*2XSTAR components. One low ionization parameter $\log(\xi)_1 \sim 1$ and $\log(\xi)_2 \sim 3$, both at the rest frame of the Galaxy ($v=0$ km/s). Model B is PL*reflionx*kdblur*2XSTAR. In this model the two absorbing components are at high-ionization state with $\log(\xi)_{1,2} \sim 3$, one at $v \sim 0$ km/s and one at $v \sim 5500$ km/s. The OVII He α line at 21.60 Å is not longer required in Model B.

REFERENCES

Crummy et al. (2006), MNRA, 365, 1067.
 Van der Meer et al. (2003), ASP Conf. Ser. 290,133.
 Steenbrugge et al. (2009), A&A, 496,107.