Galaxies and Quasars

High Resolution pre-decay X-ray spectrum of V4743 Sagittarii

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We present an analysis of the X-ray spectrum of V4743 Sagittarii, as seen with the Low Energy Transmission Grating Spectrometer (LETGS) on board Chandra, during the pre-decay phase observed in 2003 March 19. We used the absorption lines present in the spectrum for diagnostic purposes, and characterize the physics and the dynamics of the expanding atmosphere during the explosion of the nova. The spectrum is modeled with a simple black-body and multiplicative Gaussian lines, from where we are able to gain a general kinematical picture of the system. By studying the spectral evolution of the spectrum we are able to identify several H- and He-like ions of C, N, O and also but less reliable lines coming from S, Si, Ca and Ar ions. The velocity distribution of the ions shows a rather complex dynamical scenario with velocities ranging from -1000 km/s to -4500 km/s. It is shown that significant expansion and probably mass loss occur during this phase of the explosion, as already pointed out by Ness et al. (2003, 2005, 2009).

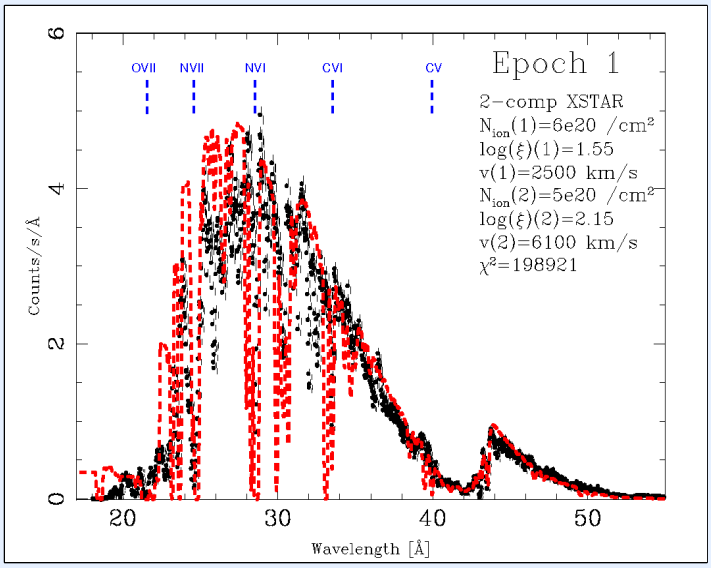

Figure 1. Chandra LETGS spectrum of V4743 in SSS phase, in the band 10-50 Å. Absorption lines from CNO are observed in the spectrum. On top, an XSTAR 2-components model is plotted.

Mass outflow in the SSS phase

From day 196 to 302, the absorption lines with the largest blue shift were replaced by corresponding emission lines, indicating that this component has become optically thin. Most likely, the fastest component is furthest away. It is shown that significant expansion and probably mass loss occur during this phase of the explosion, as already pointed out by Ness et al. (2003, 2005, 2009). The changes in opacity observed, along with the associated time scales, allow us to conclude that this is presumably a ``hot" (T ~ 5-7 x 10^5 K) plasma in recombination as opposed to a static photoionized nebula. More work on the detailed modeling of the spectrum is needed to either confirm or discard this hypothesis

References

Ness, J., Starrfield, S., Burwitz, V., et al. 2003, ApJ, 594, L127
Ness, J., et. al. 2005, MNRAS, 364, 1015
Ness, J., Starrfield, S., Page, K. L., et al. 2009b, ArXiv e-prints

X-ray Spectroscopy of the ejecta in V4743

We used the absorption lines present in the SSS spectrum for diagnostic purposes, and characterize the physics and the dynamics of the expanding atmosphere during the explosion of the nova.

In the grating spectra taken between days 180.4 and 370, we can resolve the line profiles of absorption lines arising from H-like and He-like C, N, and O, including transitions involving higher principal quantum numbers. Except for a few interstellar lines, all lines are significantly blue-shifted, yielding velocities between 1000 and 4000 km/s which implies that mass loss was ongoing. Some absorption lines consist of three distinct velocity components, indicating that we are observing different regions at the same time. The clear separation between different velocity components could indicate separate ejection events with different velocities.

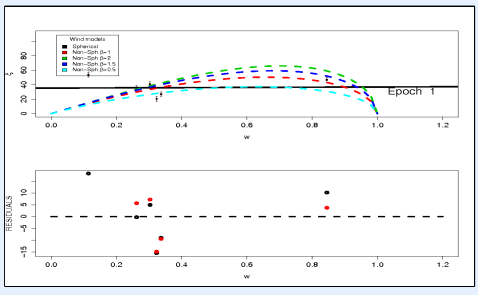

Figure 2. Physical proposed model to explain the correlation between ionization (ξ) and velocity (w, v normalized to v_{term}=7000 km/s). Spherical *vs* Non-spherical winds are compared.

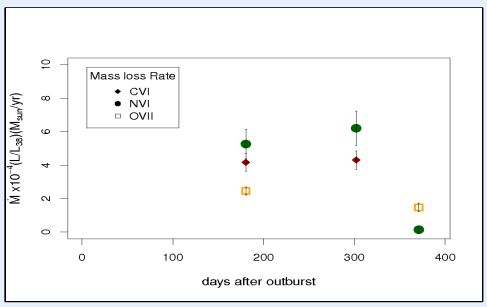

Figure 3. Mass loss rate as a function of the days after outburst.