

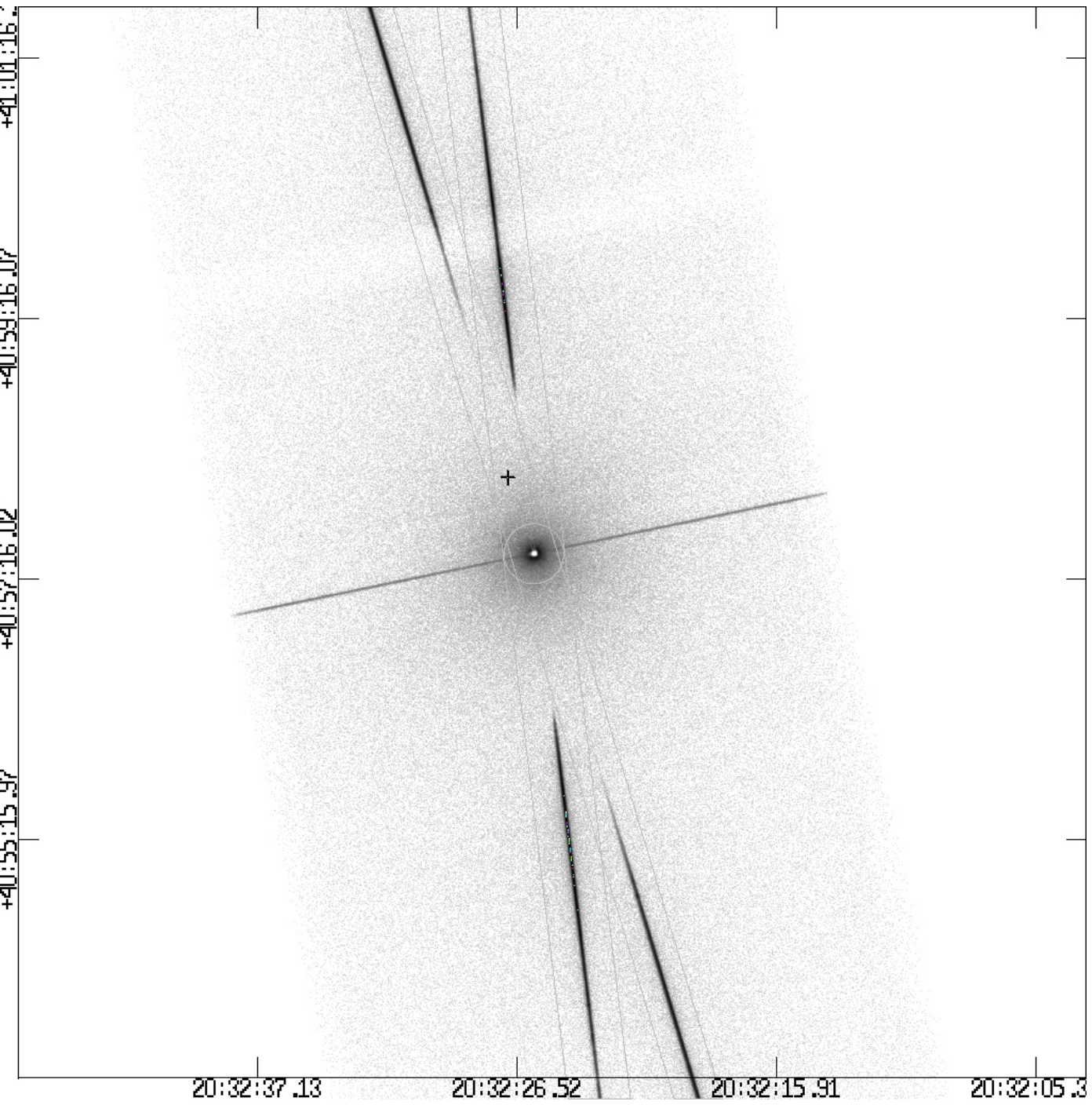
Orbital Modulation of Doppler Shifts of X-ray Spectral Features in Cygnus X-3

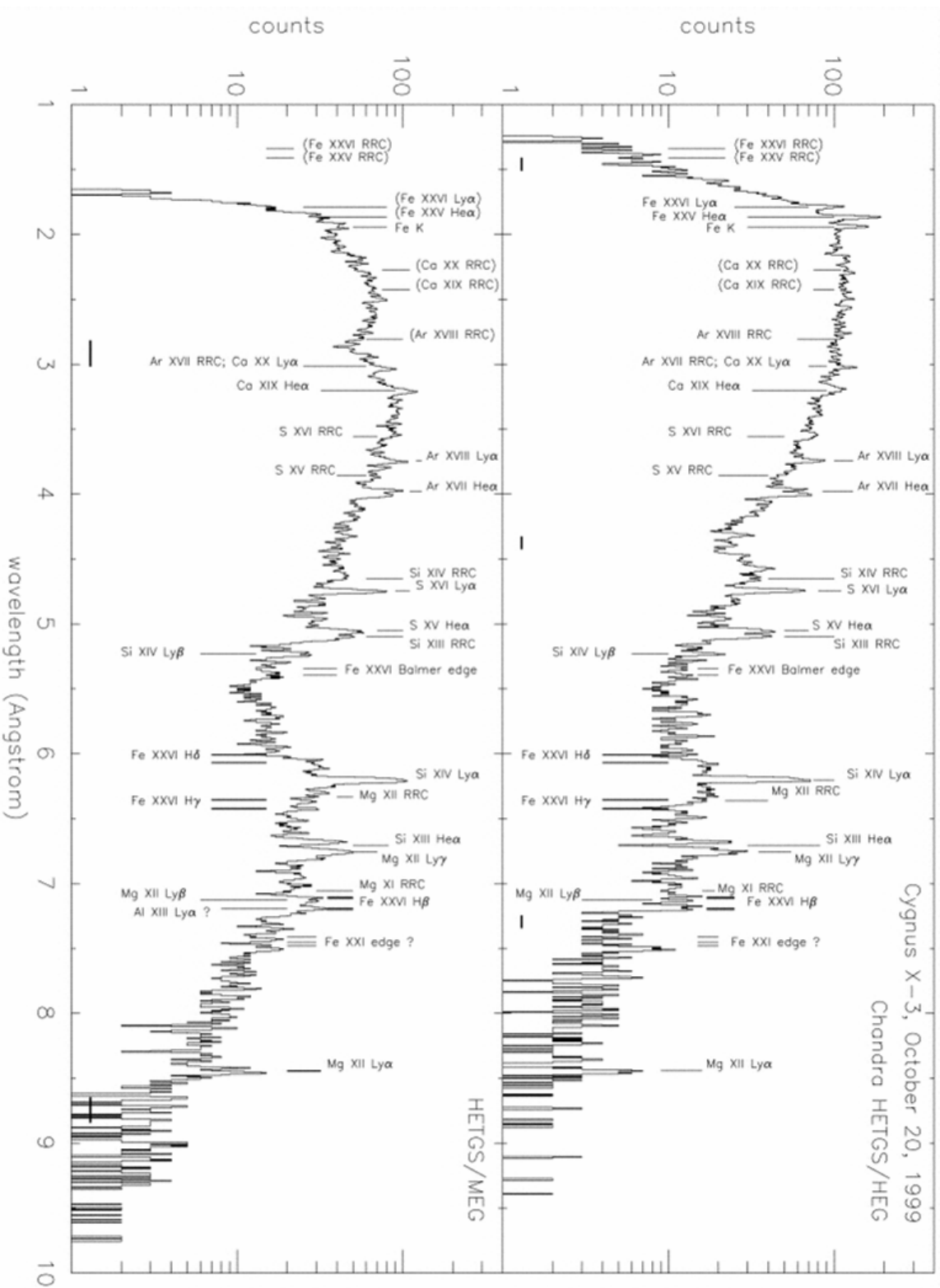
Implications for the mass
and orbital parameters
of the Cygnus X-3 system

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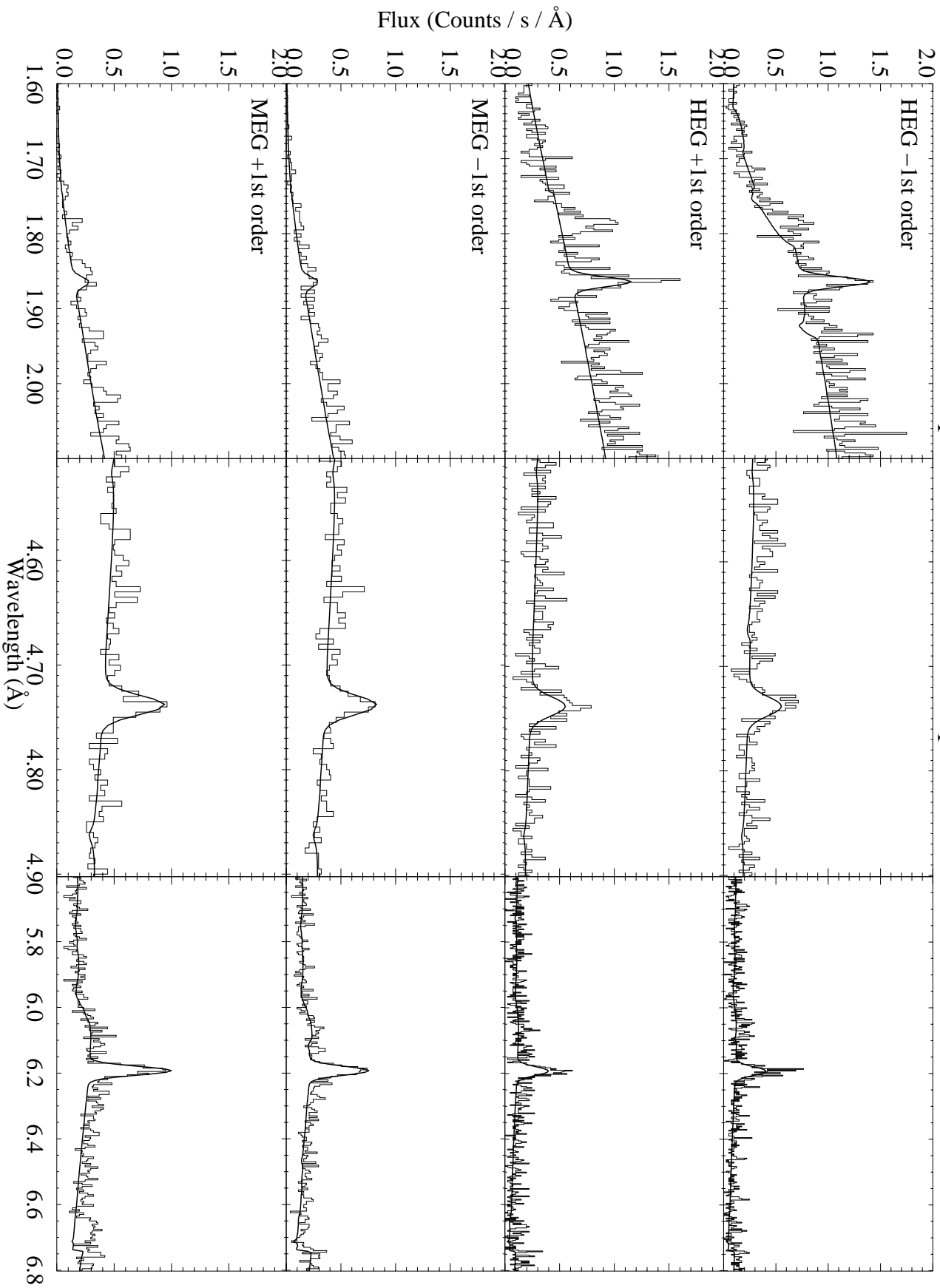


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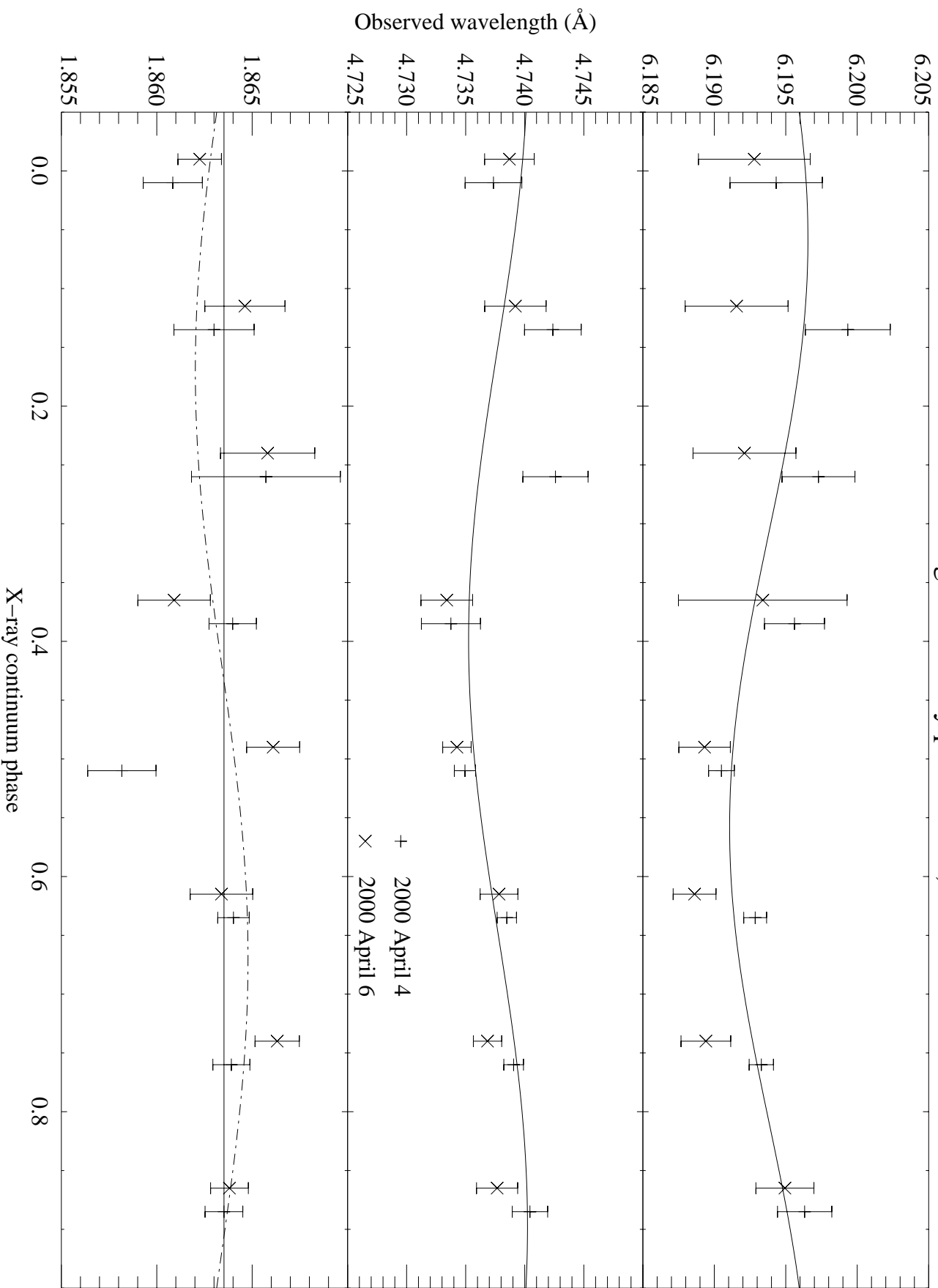


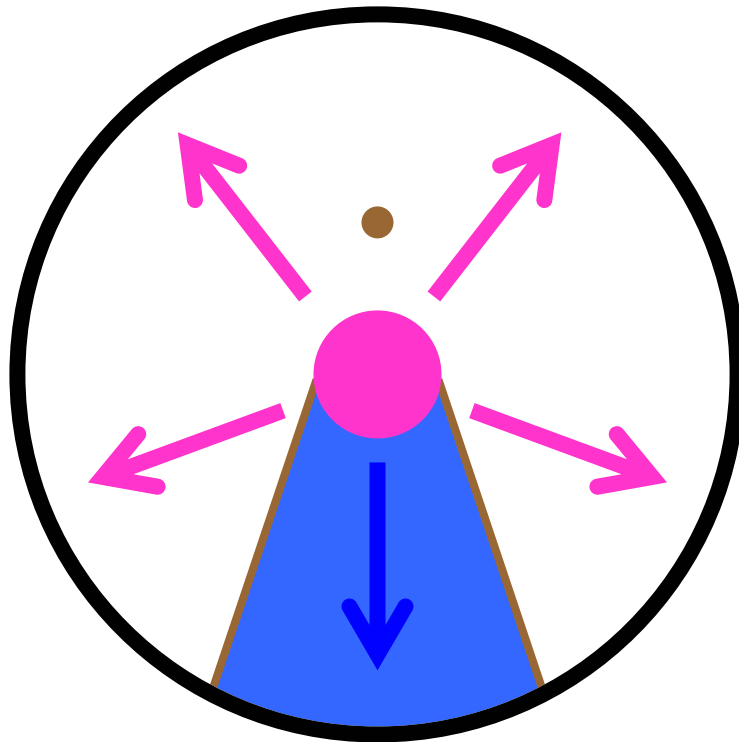


Sample Line Fits from 2000 April 4, Phase: 0.625



Line wavelength vs. X-ray phase for Si, S and Fe





Wind model of
van Kerkwijk



- X-ray minimum.
- Maximum blue shift in He line emission.
- Maximum red shift from wind passing X-ray source.
- Zero Doppler shift in emission from either star.

Line Identity	Mean Wavelength (Å)	Modulation Amplitude (Å)	Modulation Amplitude (km/s)	Phase (°)
Si XIV Ly α	6.1938 \pm 0.0006	0.0027 \pm 0.0007	133 \pm 35	21 \pm 14
S XVI Ly α	4.7377 \pm 0.0005	0.0027 \pm 0.0007	158 \pm 35	-37 \pm 14
Fe XXV He α	1.8634 \pm 0.0004	< 0.0014 90% CL	< 220	

Cygnus X-3 Mass

Orbital velocity

< 220 km/s (90% CL)

[Assuming FeXXV line Doppler shift

Indicates motion of the compact object]

$$m_f < 0.22 M_{\odot} \quad \text{Assumes } \varepsilon = 0$$

$$m_f \text{ of wind producing star} = 0.027 M_{\odot}$$

From Mason, Still &
Fender, 2000

$i = 90^\circ \Rightarrow$ Masses unphysically small

$i = 24^\circ \Rightarrow$ Compact object: $M < 3.6 M_{\odot}$

Wind star: $M < 7.3 M_{\odot}$

Conclusion

We may be actually quite close to being able to make this measurement.