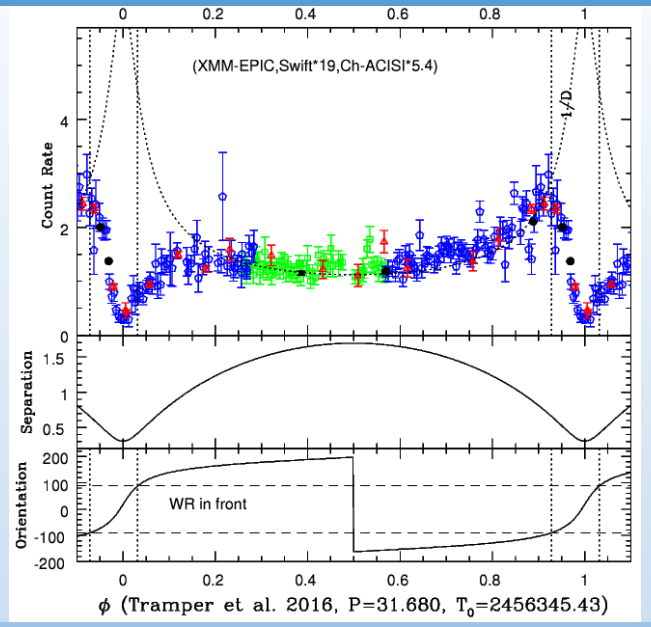
Colliding winds in massive binary systems to be diagnosed with X-IFU

Gregor Rauw, Yaël Nazé, & Enmanuelle Mossoux (STAR Institute, Liège University, Belgium)

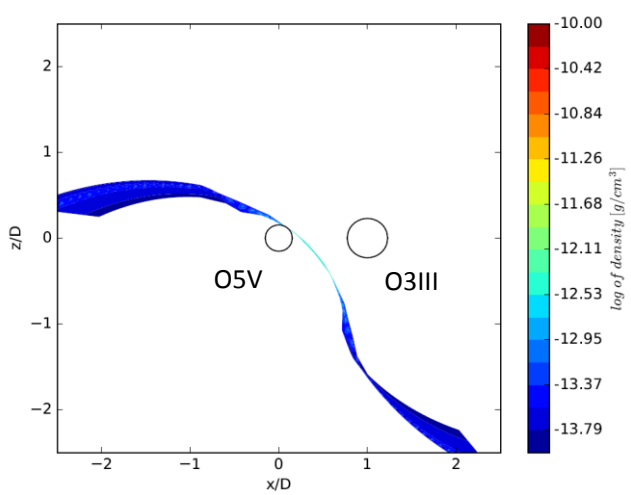
OB and Wolf-Rayet stars feature energetic stellar winds. In massive binary systems, the winds of both components collide, leading to the formation of a hot X-ray emitting plasma in the postshock region (e.g. Stevens et al. 1992; Rauw & Nazé 2016).
Image credit: NASA/C. Reed

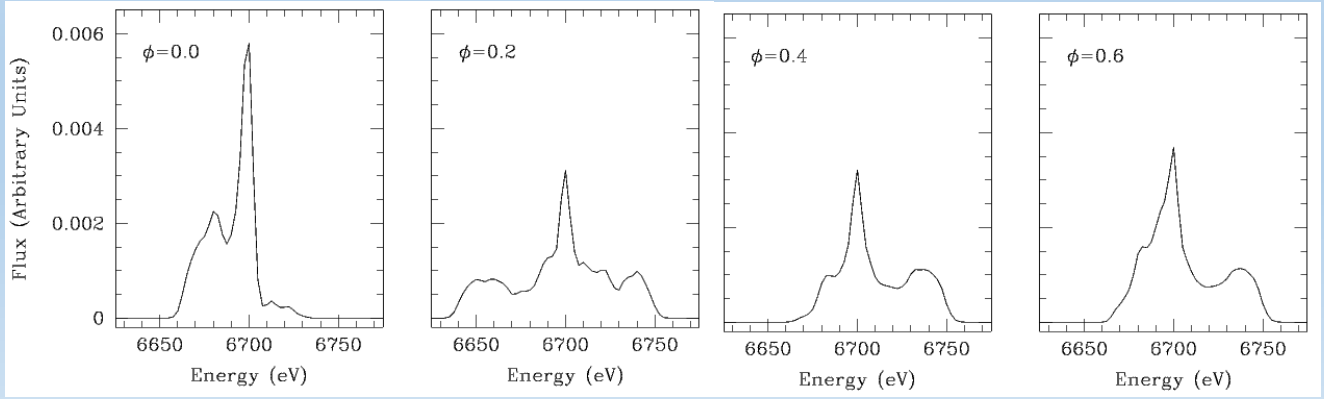


X-ray emission of colliding wind binaries (CWBs) displays phase-locked variability due to changing orbital separation in eccentric systems, changing optical depths along the line of sight, and/or shock collapsing onto the companion (e.g. WR21a Gosset & Nazé 2016).
Image credit: A&A/ESO/E. Gosset & Y. Nazé

The properties of the hot plasma in the wind interaction are best studied via high-resolution X-ray spectroscopy of the Fe xxv line complex at 6.7 keV.
Phase-resolved Athena/X-IFU observations of CWBs will allow to probe the hydrodynamics of wind interactions. To extract a maximum of information from the future observations, we have designed numerical tools to predict the morphology of these lines for a variety of configurations (Rauw et al. 2016, Mossoux & Rauw 2021).
Our models use the semi-analytical formalisms of Cantó et al. (1996) and Antokhin et al. (2004) to describe the physical properties of the shocked gas. They account for radiative inhibition (Stevens & Pollock 1994) and shock deflections due to the Coriolis force (Parkin & Pittard 2008).

Right: Simulated density in an O5V + O3III CWB with orbital period of 7.3 days computed with the LIFELINE code (Mossoux & Rauw 2021).





Left: Simulated Fe xxv resonance line profile for an O5V + O3III CWB with an orbital period of 155 days seen under i = 72°, at four different orbital phases, computed with the LIFELINE code (Mossoux & Rauw 2021).

References:
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