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Stellar wind measurements for Colliding Wind Binaries using X-ray observations

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Abstract. We report the results of the stellar wind measurement for two colliding wind binaries. The X-ray spectrum is the best measurement tool for the hot postshock gas. By monitoring the changing of the the X-ray luminosity and column density along with the orbital phases, we derive the mass-loss rates of these stars.

Keywords. binaries: spectroscopic, stars: Wolf-Rayet, X-rays: stars, stars: mass loss

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1. Introduction

Mass-loss is one of the most important and uncertain parameters in the evolution of a massive star. Colliding wind binary is the best testing ground for plasma shock physics, because plasma properties vary with binary separations. We have reported an approach to determine a mass-loss rate of a binary system with a highly eccentric orbit with X-ray multi-phase spectroscopy (Sugawara *et al.* 2015). In this paper. we select WR21a (O3/WN5ha+O3Vz((f*))) and WR25 (WN6h+O4f) as samples.

2. Wind measurements

In the case of WR21a, we fitted the X-ray spectra from XMM-Newton with two absorbed thin thermal plasma model. As periastron approached, the local column density increased, which can be explained as self-absorption by the W-R wind. Therefore, the local column density (mass-loss rate) can be expressed as the integral from the X-ray emitting region (a compact region around periastron) to infinite distance along the line of sight. Using the column densities from spectral fitting, our estimated mass-loss rate for primary star of WR21a is $(5.5 \pm 1.0) \times 10^{-6}$ $M_{\odot}$ yr^{-1}. This is consistent the results using the similar method (Gosset & Nazé 2016).

In the case of WR25, we used the reported local column density data measured by XMM-Newton (Pandy *et al.* 2014). The column density data could be reproduced by the model using low eccentricity value (e =0.35) and low inclination angle (i <10°). Our estimate for W-R (WN) star is 5.1×10^{-5} $M_{\odot}$ yr^{-1}. By using this method for WR25, we could limit not only mass-loss rate but also orbital inclination angle.

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