

# Measuring the stellar wind parameters in IGR J17544-2619 and Vela X-1 constrains the accretion physics in Supergiant Fast X-ray Transient and classical Supergiant X-ray Binaries

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Classical Supergiant X-ray Binaries (SGXBs) and Supergiant Fast X-ray Transients (SFXTs) are two types of High-mass X-ray Binaries (HMXBs) that present similar donors but, at the same time, show very different behavior in the X-rays. The reason for this dichotomy of wind-fed HMXBs is still a matter of debate. Among the several explanations that have been proposed, some of them invoke specific stellar wind properties of the donor stars. Only dedicated empirical analysis of the donors' stellar wind can provide the required information to accomplish an adequate test of these theories. However, such analyses are scarce. To close this gap, we perform a comparative analysis of the optical companion in two important systems: IGR J17544-2619 (SFXT) and Vela X-1 (SGXB). We analyse the spectra of each star in detail and derive their stellar and wind properties. We compare the wind parameters, giving us an excellent chance of recognizing key differences between donor winds in SFXTs and SGXBs. We find that the stellar parameters derived from the analysis generally agree well with the spectral types of the two donors: O9I (IGR J17544-2619) and B0.5Iae (Vela X-1). An important difference between the stellar winds of the two stars is their terminal velocities  $v_{\infty}=1500\text{km/s}$  in IGR J17544-2619 and  $v_{\infty}=700\text{km/s}$  in Vela X-1, which has important consequences on the X-ray luminosity of these sources. Their specific combination of wind speed and pulsar spin favours an accretion regime with a persistently high luminosity in Vela X-1, while it favours an inhibiting accretion mechanism in IGR J17544-2619. Our study demonstrates that the wind relative velocity is critical in the determination of the class of HMXBs hosting a supergiant donor, given that it may shift the accretion mechanism from direct accretion to propeller regimes when combined with other parameters.

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