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REVEALING ACCRETION GEOMETRY ON SUPERGIANT HIGH MASS X-RAY BINARIES THROUGH X-RAY WIND TOMOGRAPHY.

Abstract

About one and a half dozen of persistently highly absorbed super-giant high-mass X-ray binaries (sgHMXB) have been discovered by INTEGRAL as bright, hard X-ray sources with relatively weak X-ray counterparts. Our goal is to understand the characteristics of highly absorbed sgHMXB and, in particular, the companion stellar wind, which is thought to be responsible for the strong absorption. We used all available archival data from XMM-Newton, NuSTAR, and Neil Gehrels Swift Observatory of the obscured system IGR J18027-2016, a relatively highly absorbed system featuring eclipses implying a higher inclination angle. Using all telescopes as mentioned above, we aim to study the variability of the absorbing column density (nH) and the very weak Fe K emission line along the orbit and during the eclipses.

To get an accurate determination of the orbital phases, we are applying an approach to get a redefined orbital solution, using all available archival data from large Field-of-View (FoV) and/or all-sky-monitors (ASM) like INTEGRAL/IBIS, Swift/BAT, and MAXI instruments. In addition, we anticipate including the Pulse Arrival Times (PAT) from the pre-existing XMM-Newton, NuSTAR, and Swift observations, when available in relatively good accuracy. Significant variations of the absorbing column density (nH) have been detected in all observations, implying the presence of a structure within the wind, interrupting the line of sight between the observer and the X-ray source.

In this regard, a grid of 2D global hydrodynamic simulations modeling the stellar wind is currently being conducted. The postprocessing of these models will allow us for a direct comparison of the absorbing column density (nH) with the observations in order to constrain the stellar wind characteristics. We anticipate studying the weak Fe K line equivalent width variability along the orbit and around the eclipse. Early outcome of our hydrodynamical simulation suggests that an extended structure will be present along most of the orbit, indicating that the stellar wind has been strongly disrupted due to X-ray photoionization and accretion wake.