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Resolving Binary Systems down to Milli-Arcsecond Precision through Stellar Intensity Interferometry with MAGIC and LST-1

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The MAGIC telescopes are two imaging atmospheric Cherenkov telescopes (IACTs) located at the Roque de los Muchachos Observatory (La Palma, Spain). Many observations performed with a high night-sky background have been dedicated to stellar intensity interferometry (SII), since very-high-energy (VHE, 20 GeV - 100 TeV) gamma-ray observations have reduced sensitivity during these periods. The observations performed between 2021 and 2023 resulted in the measurement of 13 new angular diameters of stars in the blue band, as reported in a performance paper published in 2024. In early 2024, the neighboring first Large-Sized Telescope (LST-1) of the Cherenkov Telescope Array Observatory was added to the optical interferometer. The high angular resolution and the broad simultaneous UV coverage achieved with this setup can be exploited to study binary systems, targeting massive stars with angular separations of the order of a few milli-arcseconds. These high-resolution observations can potentially resolve the orbital parameters of the binary system, the angular size of each component, and their brightness ratio. These observational properties are directly related to the physical components of the system and can be used to understand their stellar evolution. Furthermore, some of these binary systems are known to produce VHE gamma-ray emission via colliding stellar winds, making them perfect candidates to be studied with IACTs. Following the growing interest in SII in recent years, we present the status and detection capabilities for binary stellar systems using the MAGIC+LST-1 optical interferometer.

Collaboration(s)

the MAGIC Collaboration, the LST Collaboration

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