

# **Multiplicity of northern bright O-type stars with optical long baseline interferometry. Results of the pilot study.**

**Cyprien Lanthermann<sup>1</sup> Jean-Baptiste Le Bouquin<sup>2</sup> Hugues Sana<sup>3</sup>  
Antoine Mérand<sup>4</sup> John Monnier<sup>5</sup> Karine Perraut<sup>2</sup> Abigail J. Frost<sup>6</sup>  
Laurent Mahy<sup>7</sup> Eric Gossett<sup>8</sup> Michael De Becker<sup>8</sup> Stefan Kraus<sup>9</sup>  
Narsireddy Anugu<sup>1</sup> Claire L. Davies<sup>9</sup> Jacob Ennis<sup>5</sup> Tyler Gardner<sup>9</sup>  
Aaron Labdon<sup>6</sup> Benjamin Setterholm<sup>5</sup> Theo Ten Brummelaar<sup>1</sup>  
Gail Schaefer<sup>1</sup>**

<sup>1</sup>CHARA Array - Georgia State University, <sup>2</sup>IPAG, <sup>3</sup>KU Leuven, <sup>4</sup>ESO Garching,

<sup>5</sup>University of Michigan, Ann Arbor, <sup>6</sup>ESO Chile, <sup>7</sup>Royal Observatory of Belgium,,

<sup>8</sup>Space sciences, Technologies, and Astrophysics Research (STAR) Institute, University of Liège,

<sup>9</sup>Exeter

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The study of the multiplicity of massive stars gives hints on their formation processes and their evolutionary paths, which are still not fully understood. Large separation binaries ( $>50$  milliseconds of arc, mas) can be probed by adaptive-optics-assisted direct imaging and sparse aperture masking, while close binaries can be resolved by photometry and spectroscopy. However, optical long baseline interferometry is mandatory to establish the multiplicity of Galactic massive stars at the separation gap between 1 and 50 mas. In this study, we aimed to demonstrate the capability of the new interferometric instrument MIRC-X, located at the CHARA Array, to study the multiplicity of O-type stars and therefore probe the full range of separation for more than 120 massive stars ( $H < 7.5$  mag). We initiated a pilot survey of bright O-type stars ( $H < 6.5$  mag) observable with MIRC-X. We observed 29 O-type stars, including two systems in average atmospheric conditions around a magnitude of  $H = 7.5$  mag. We systematically reduced the obtained data with the public reduction pipeline of the instrument. We analyzed the reduced data using the dedicated python software CANDID to detect companions. Out of these 29 systems, we resolved 19 companions in 17 different systems with angular separations between  $\sim 0.5$  and 50 mas. This results in a multiplicity fraction  $f_m = 17/29 = 0.59 \pm 0.09$ , and an average number of companions  $f_c = 19/29 = 0.66 \pm 0.13$ . Those results are in agreement with the results of the SMASH+ survey in the Southern Hemisphere. Thirteen of these companions have been resolved for the first time, including the companion responsible for the nonthermal emission in Cyg OB2-5 A and the confirmation of the candidate companion of HD 47129 suggested by SMASH+. We concluded that a large survey on more than 120 northern O-type stars ( $H < 7.5$ ) is possible with MIRC-X and will be fruitful. The large survey is currently on-going.