
VLTI-AMBER velocity-resolved aperture-synthesis imaging of Eta Car's wind-wind collision zone

Gerd Weigelt*^{†1}, Karl-Heinz Hofmann¹, Dieter Schertl¹, Nicola Clementel², Michael Corcoran³, Augusto Daminieli⁴, Willem-Jan De Wit⁵, Rebekka Grellmann⁶, Jose Groh⁷, Sylvain Guieu⁵, Ted Gull⁸, Kenji Hamaguchi⁹, Matthias Heininger¹, Desmond Hillier^{‡10}, Christian Hummel¹¹, Stefan Kraus¹², Tom Madura¹³, Andrea Mehner⁵, Antoine Merand¹¹, Florentin Millour¹⁴, Anthony Moffat¹⁵, Keiichi Ohnaka¹⁶, Fabien Patru¹⁷, Romain Petrov¹⁴, Sridharan Rengaswamy¹⁸, Noel Richardson¹⁹, Thomas Rivinius⁵, Markus Schöller¹¹, Mairan Teodoro⁸, and Markus Wittkowski¹¹

¹Max Planck Institute for Radio Astronomy – Germany

²South African Astronomical Observatory – South Africa

³CRESST and X-ray Astrophysics Laboratory, Goddard Space Flight Center; Universities Space Research Association – United States

⁴Instituto de Astronomia, Geofísica e Ciências Atmosféricas, Universidade de São Paulo – Brazil

⁵European Southern Observatory – Chile

⁶I. Physikalisches Institut, Universität zu Köln – Germany

⁷School of Physics, Trinity College Dublin, The University of Dublin – Ireland

⁸Astrophysics Science Division, Goddard Space Flight Center – United States

⁹CRESST and X-ray Astrophysics Laboratory, NASA/GSFC; Department of Physics, University of Maryland – United States

¹⁰Department of Physics and Astronomy Pittsburgh Particle Physics, Astrophysics, and Cosmology Center (PITT PACC), University of Pittsburgh – United States

¹¹European Southern Observatory – Germany

¹²University of Exeter, Astrophysics Group – United Kingdom

¹³Department of Physics and Astronomy, San Jose State University – United States

¹⁴Laboratoire Lagrange, UMR7293, Université de Nice Sophia-Antipolis, CNRS, Observatoire de la Côte d'Azur – CNRS : UMR7293 – France

¹⁵Département de physique and Centre de Recherche en Astrophysique du Québec (CRAQ), Université de Montréal – Canada

¹⁶Universidad Católica del Norte, Instituto de Astronomía, Chile – Chile

¹⁷Osservatorio Astrofisico di Arcetri – Italy

¹⁸Indian Institute of Astrophysics – India

¹⁹Ritter Observatory, Department of Physics and Astronomy, The University of Toledo – United States

Abstract

*Speaker

†Corresponding author: weigelt@mpifr.de

‡Corresponding author: hillier@pitt.edu

Eta Car is a unique object for studying the massive stellar winds in a wind-collision binary during the LBV phase. X-ray studies show that there is a phase-dependent wind collision zone in Eta Car. We present velocity-resolved Eta Car images reconstructed in more than 100 different spectral channels distributed across the Brackett Gamma emission line. Interferometry can provide information on the orbit, the primary wind, and the wind collision. The obtained images of Eta Car's primary star wind and wind collision zone have a spatial resolution of 6 mas (14 au) and high spectral resolution of 12000. For example, at wavelengths corresponding to radial velocities of -140 to -376 km/s, the intensity distribution has a fan-shaped structure. The fan extends 8.0 mas (19 au) to the southeast and 5.8 mas (14 au) to the northwest. The shapes of the velocity-resolved intensity distributions suggest that the obtained images are the first images of the innermost wind collision zone. Therefore, the observations provide time- and velocity-dependent image structures that can be used to test 3-D hydrodynamical models of the massive interacting winds of Eta Car.

Keywords: Eta Car, massive stars, mass loss, winds, interferometry