

# Near-infrared integral field spectroscopy of the Homunculus nebula around Eta Carinae using Gemini/CIRPASS

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This work presents the first integral field spectroscopy of the Homunculus nebula around Eta Carinae in the near-infrared spectral region (J band). We confirmed the presence of a hole on the polar region of each lobe, as indicated by previous near-IR long-slit spectra and mid-IR images. The holes can be described as a cylinder of height (i.e. the thickness of the lobe) and diameter of 6.5 and  $6.0 \times 10^{16}$  cm, respectively. We also mapped the blue-shifted component of He I 10830 seen towards the NW lobe. Contrary to previous works, we suggested that this blue-shifted component is not related to the Paddle but it is indeed in the equatorial disc. We confirmed the claim of Smith (2005) and showed that the spatial extent of the Little Homunculus matches remarkably well the radio continuum emission at 3 cm, indicating that the Little Homunculus can be regarded as a small HII region. Therefore, we used the optically-thin 1.3 mm radio flux to derive a lower limit for the number of Lyman-continuum photons of the central source in Eta Car. In the context of a binary system, and assuming that the ionising flux comes entirely from the hot companion star, the lower limit for its spectral type and luminosity class ranges from O5.5 III to O7 I. Moreover, we showed that the radio peak at 1.7 arcsec NW from the central star is in the same line-of-sight of the 'Sr-filament' but they are obviously spatially separated, while the blue-shifted component of He I 10830 may be related to the radio peak and can be explained by the ultraviolet radiation from the companion star.

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