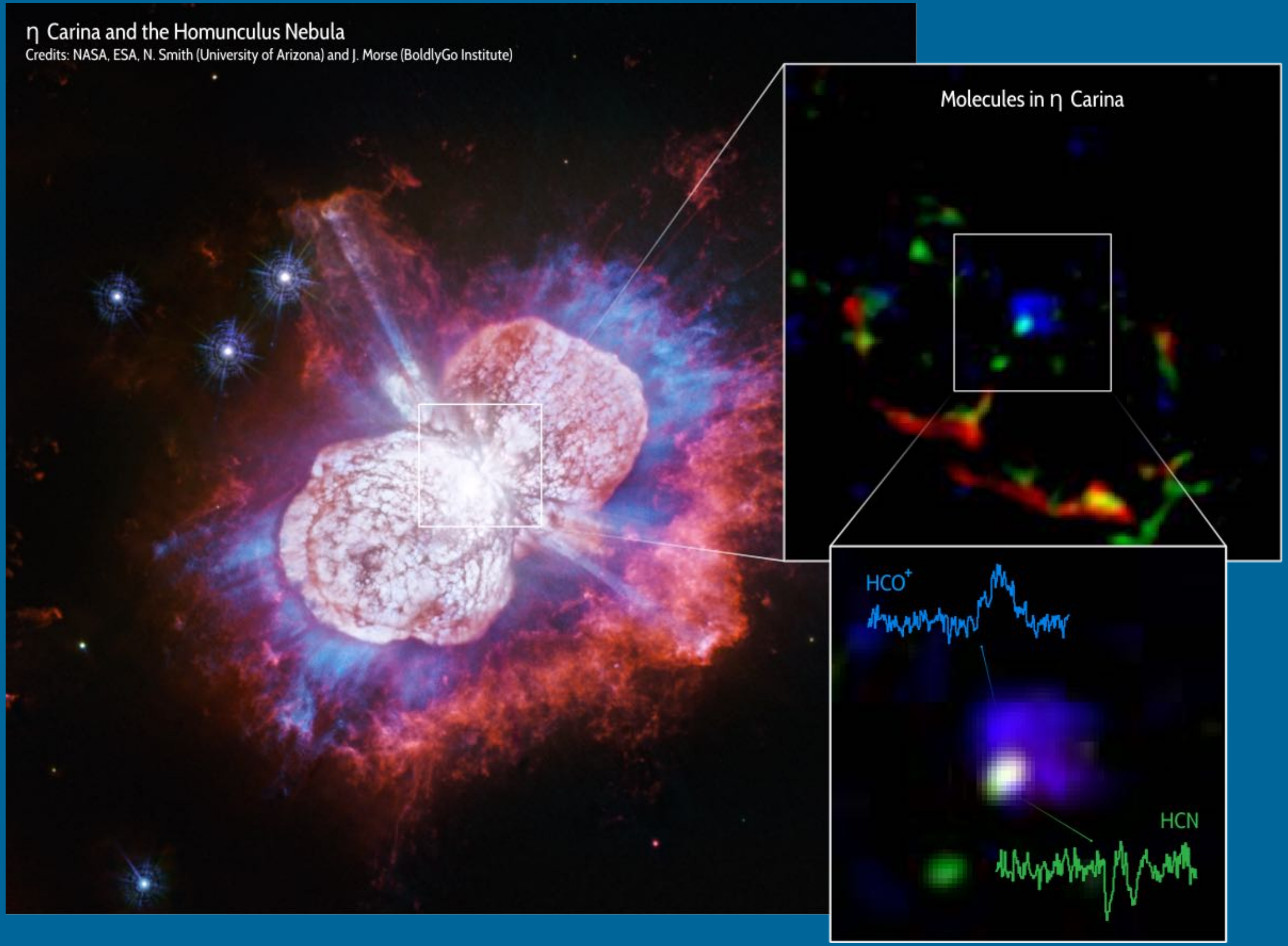
The peculiar chemistry of the inner ejecta of η Carina



Composite image of η Carina and the Homunculus Nebula. The insets show a closer view of the molecular material detected: the equatorial ring –a vestige of the 1840s Great Eruption– where carbon monoxide (red) and nitrogenated species (green) are entangled; and the innermost ejecta: the cloud and the bullet.

η Carina is a **super-massive binary system** 7500 light-years away from Earth. The largest star in the system is an evolved, very luminous star about to explode as a supernova. In the 19th century, **η Car experienced two gigantic eruptions**, expelling several solar masses of dust and gas and forming the spectacular Homunculus Nebula. This ejected material, rich in heavy elements from the stellar interior, is the perfect **breeding ground for organic molecules**, which are the building blocks of life.

Thanks to ALMA's unparalleled resolving power, the molecular material around η Car can be studied with unprecedented detail. So far, only the distribution of carbon monoxide was known, forming a clumpy ring in the waist of the bipolar nebula. This work reports the **detection of two new structures** right in the heart of the Homunculus: a **small cloud of dust and gas**, likely expelled during the 1890s eruption, that is slowly moving outwards through the turbulent region where the winds of the two stars collide; and **a hot bullet of gas** expelled by the main star, rich in nitrogen.

These two structures display an **unusual chemical composition**, being traced by the formyl ion (blue) and hydrogen cyanide (green) respectively. In contrast to the outer ring, no carbon monoxide (red) is found in the inner ejecta, which is particularly puzzling as this molecule is ubiquitous in the universe. This situation is **hardly explained by standard chemical models**, so further observations are needed to solve this mystery and constrain the chemical evolution of the ejecta. Understanding how molecules form in the outskirts of the most massive stars has **important astrobiological implications**, shedding light on the chemical enrichment of the early universe.

BORDIU, C., RIZZO, J.R., 2019, MNRAS, 490, 1570 HTTPS://DOI.ORG/10.1093/MNRAS/STZ2621