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Yi-Kuan Chiang

Institute of Astronomy, NTHU

A SMOKING GUN IN THE CARINA NEBULA

Hamaguchi, K., et al. 2009, apjl, 695, L4

Carina Nebula

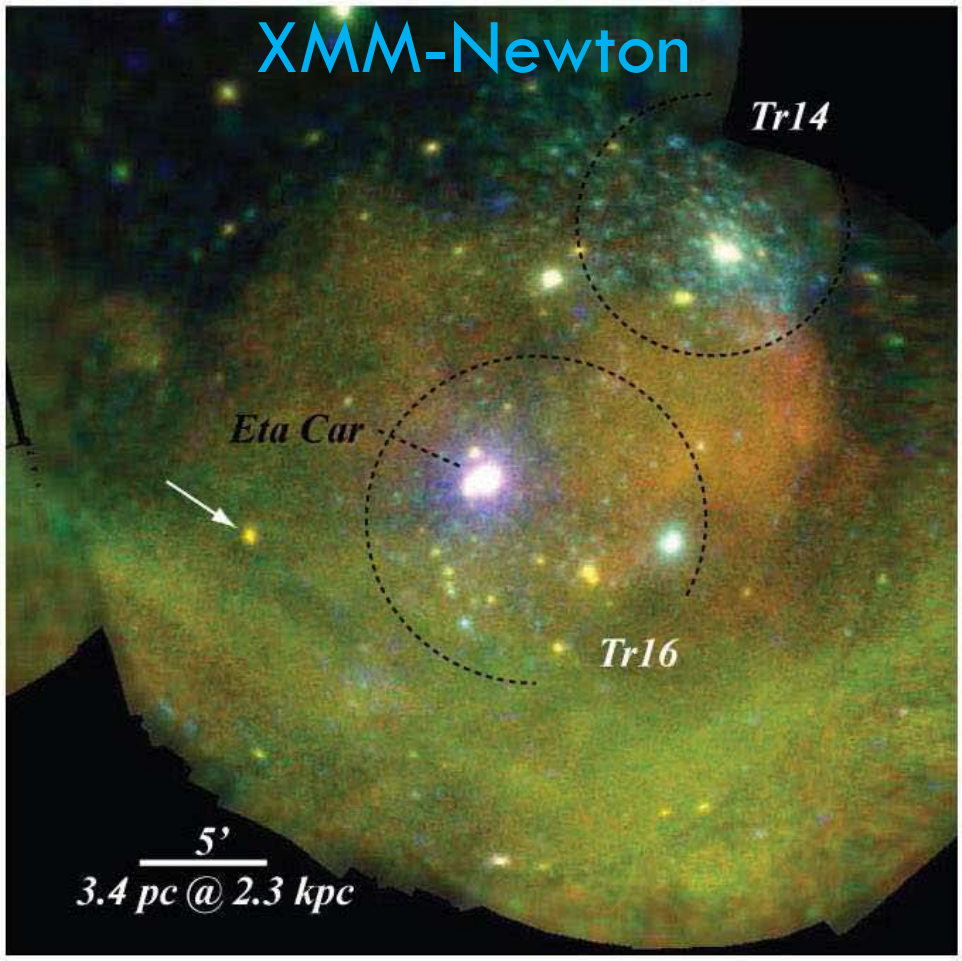
- One of the youngest, most active sites of massive star formation in our Galaxy
- Two massive stellar clusters, Trumpler 14 and 16
- Over 50 massive stars with spectral types earlier than O6 (40 $M_{\odot}$)
- One of the most massive stars in our Galaxy, η Carinae, which has an estimated initial mass $\geqq 150\ M_{\odot}$ and a currentmass of about 90 $M_{\odot}$ (Hillier et al. 2001)
- Distance: ~ 2.3 kpc
- One of the best sites for studying how very massive stars form and affect their environment

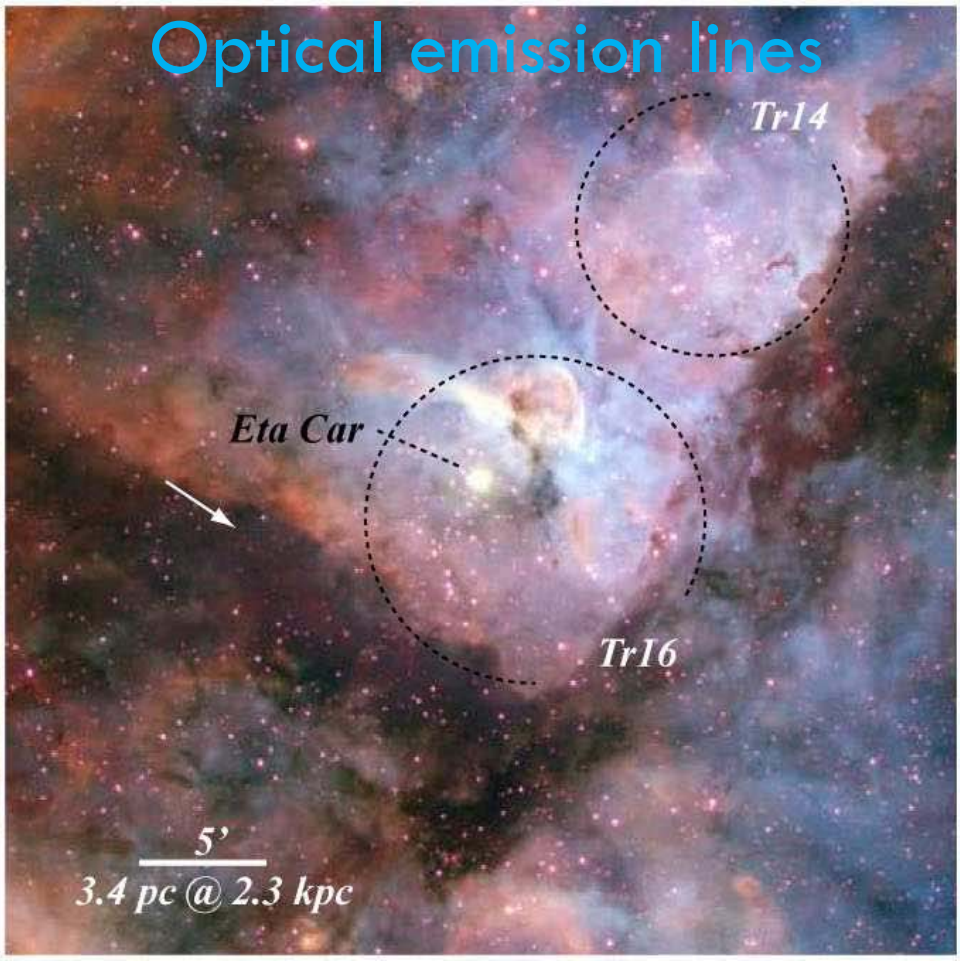
Carina Nebula

- It shows signatures of violent activities:
  - a bipolar supershell structure (Smith et al. 2000)
  - strong turbulence in interstellar clouds (Yonekura et al. 2005)
  - hot X-ray plasma through the entire nebula (Seward et al. 1979; Townsley 2006; Hamaguchi et al. 2007;Ezoe et al. 2008)
- Two primary mechanisms have been proposed to produce these structures:
  - strong winds and UV radiation from massive stars
  - supernova explosions
- The energy budget and elemental abundance distribution favor the supernova mechanism (Yonekura et al. 2005; Hamaguchi et al. 2007)
- However, neither black hole, neutron star, nor clear remnant from a supernova, has been found before.

News

- they found a promising neutron star candidate at the heart of the Carina Nebula.





Source properties

- persisted for about 30 years with intrinsic X-ray luminosity of $\sim 4.6\times10^{32}$ ergs s^{-1}
- kT ~ 128 eV blackbody radiation
- $N_H \sim 3.2\pm0.4\times10^{21}$ cm^{-2}

  Consistent with interstellar absorption to the Carina Nebula (not AGN) and significantly smaller than absorption to the background stars in the field
- no counterpart in the radio, optical, near- and mid-infrared wavelengths
- log $F_X/F_{bol} > -0.7$ (not star)
- The X-ray spectrum suggests that it is a neutron star
- Age: $0.5-1\times10^6$-years. (The Trumpler14 and 16 clusters occurred less than 3×10^6 years ago.)

Conclusion

- This result suggests that the Carina Nebula experienced at least two major episodes of massive star formation.

  (Any massive supernova progenitor is unlikely to be co-eval with the observed stars since it would be more massive than η Carinae.)
- The neutron star may be responsible for remnants of high energy activity seen in multiple wavelengths.

Thank you