

# Great Observatories

Jonathan F. Ormes

Space Sciences Director, GSFC, Emeritus  
University of Denver

Winter, 2019

Wind Crest Learners  
Academy for Lifelong Learning

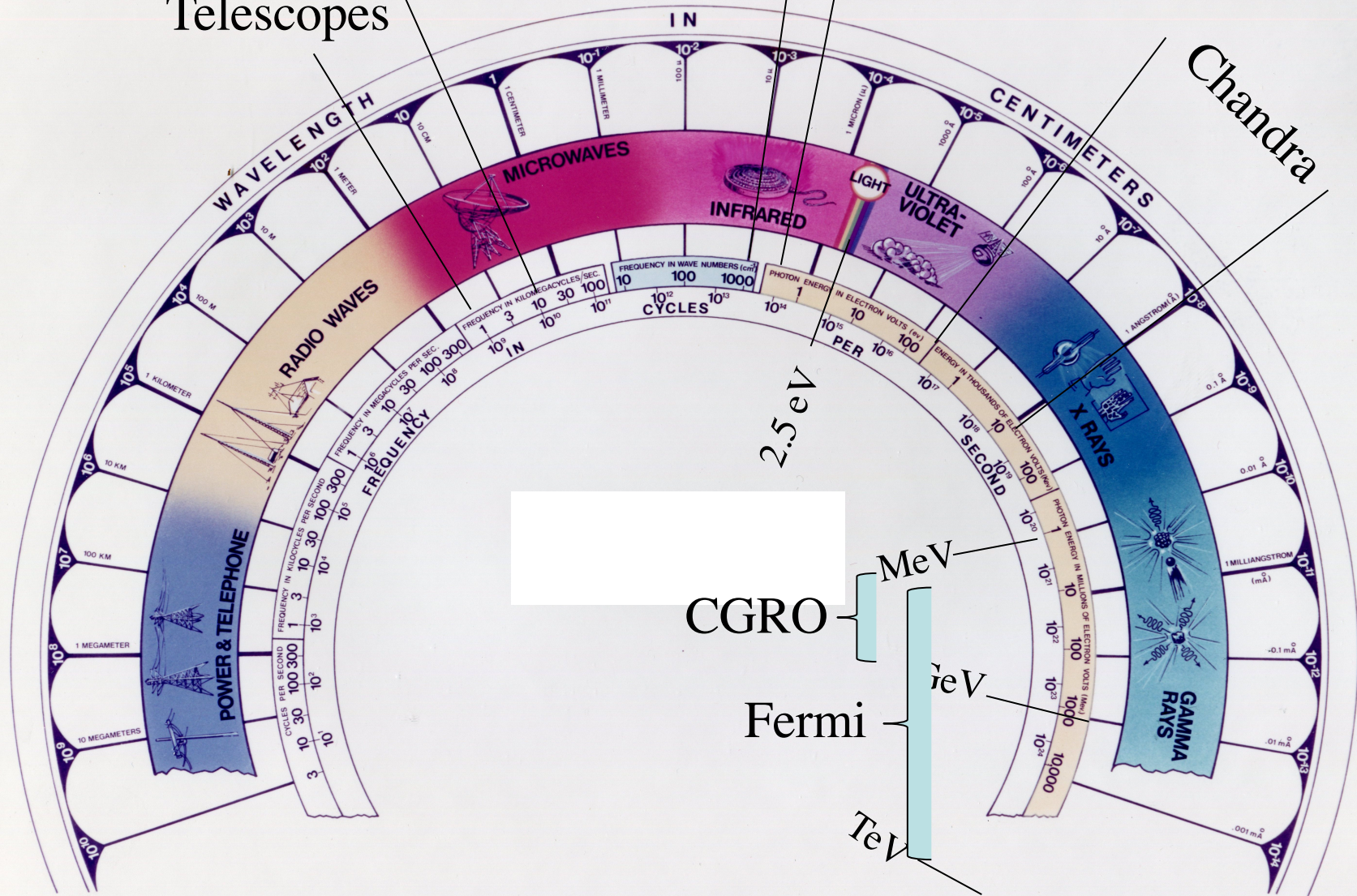
# What other eyes do we have?

- The Great Observatories
  - Gamma Ray Observatory
  - Hubble Space Telescope
    - Built at MSFC, transferred to GSFC for operations
    - Optics repaired (Senator Mikulski “Techno-turkey”)
    - Instruments updated spacecraft repairs
    - 1993 (mirror corrected), 1997, 1999, 2002, 2009
  - Chandra X-ray Observatory
  - Spitzer Infrared Observatory

# Radio Telescopes

Spitzer

Chandra





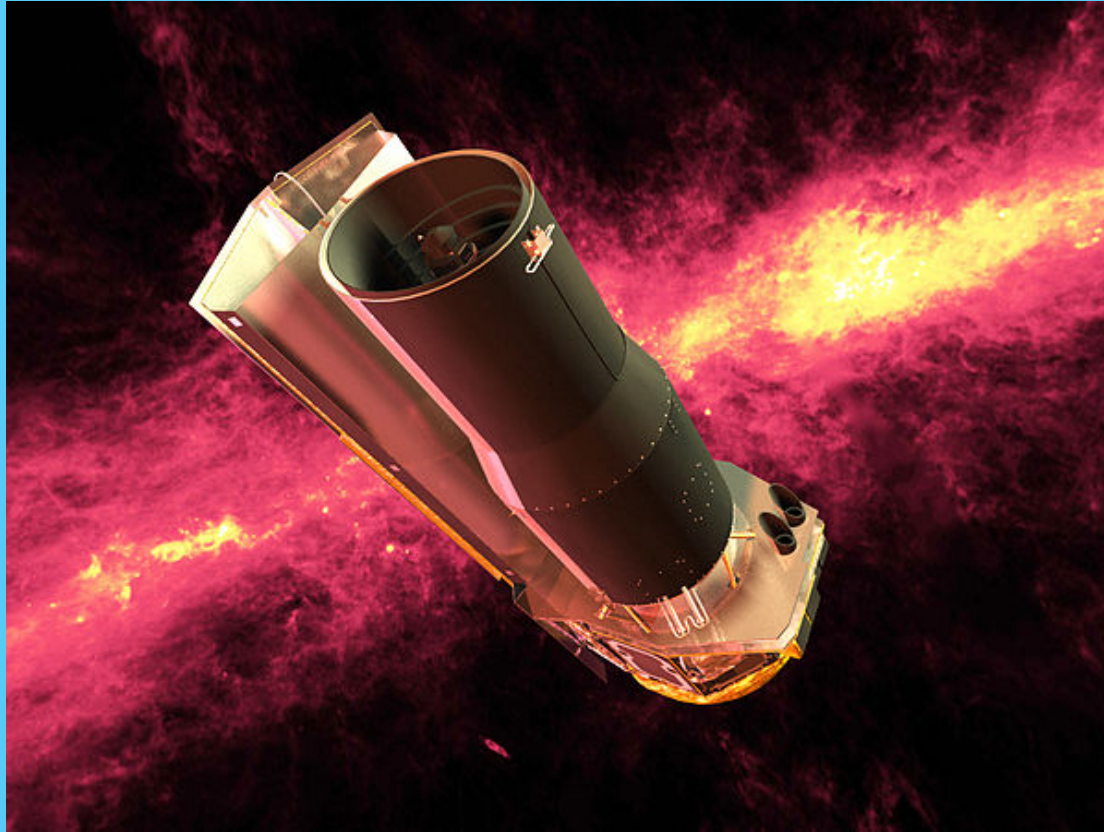
# Great Observatories

Wavelength ----->



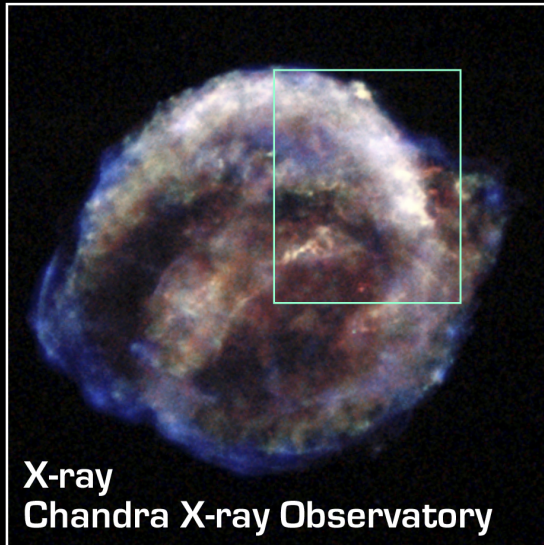
←-----Energy and Temperature



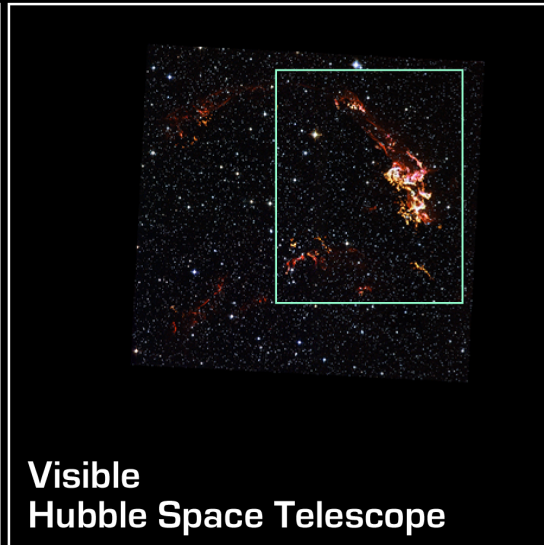


## Spitzer Infrared Telescope Facility

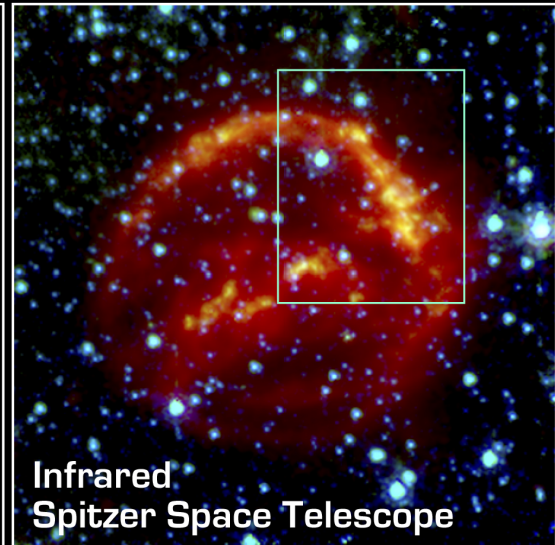
### Space Infrared Telescope Facility



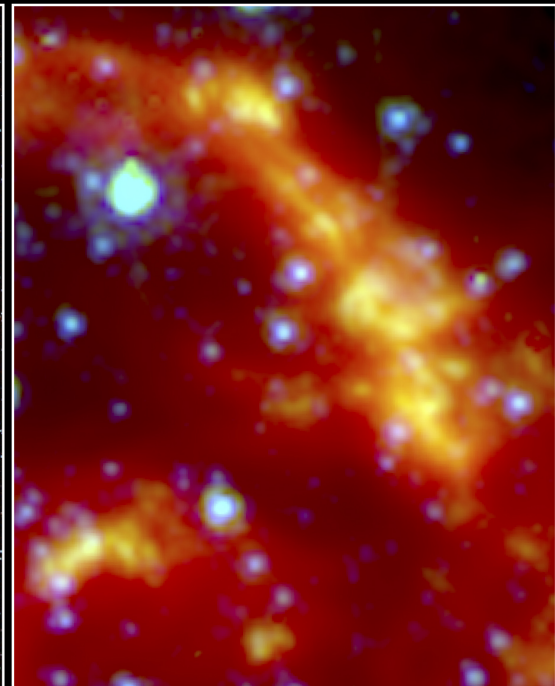
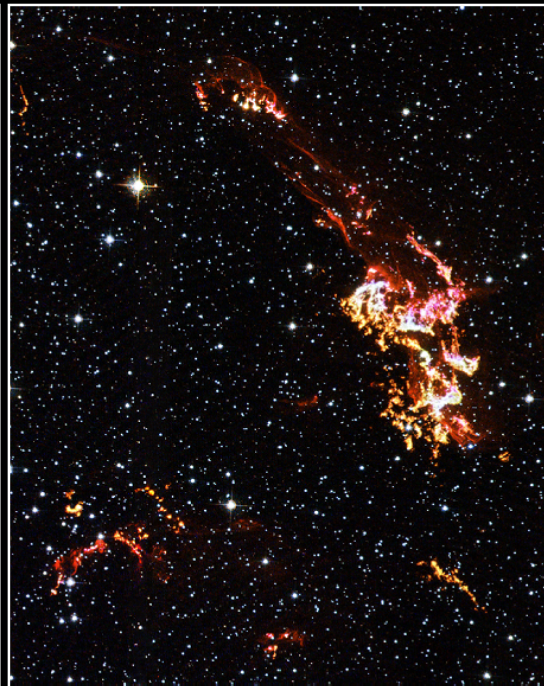
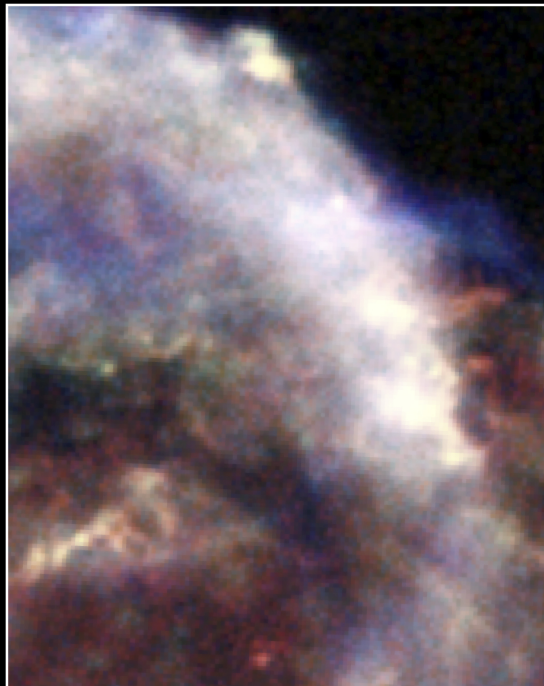
X-ray  
Chandra X-ray Observatory



Visible  
Hubble Space Telescope



Infrared  
Spitzer Space Telescope



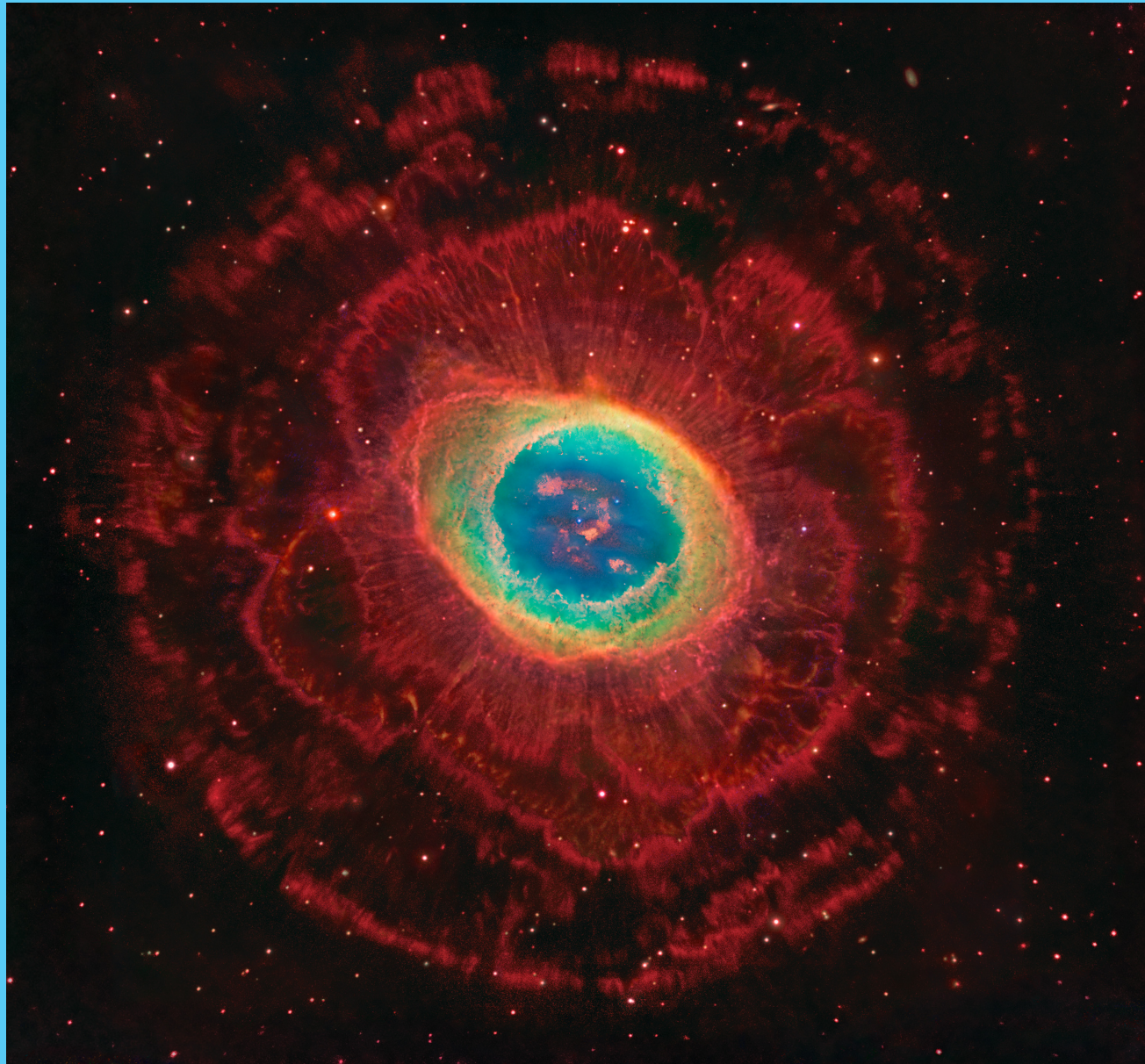
## Kepler's Supernova Remnant • SN 1604

NASA, ESA / JPL-Caltech / R. Sankrit & W. Blair (Johns Hopkins University)

ssc2004-15b

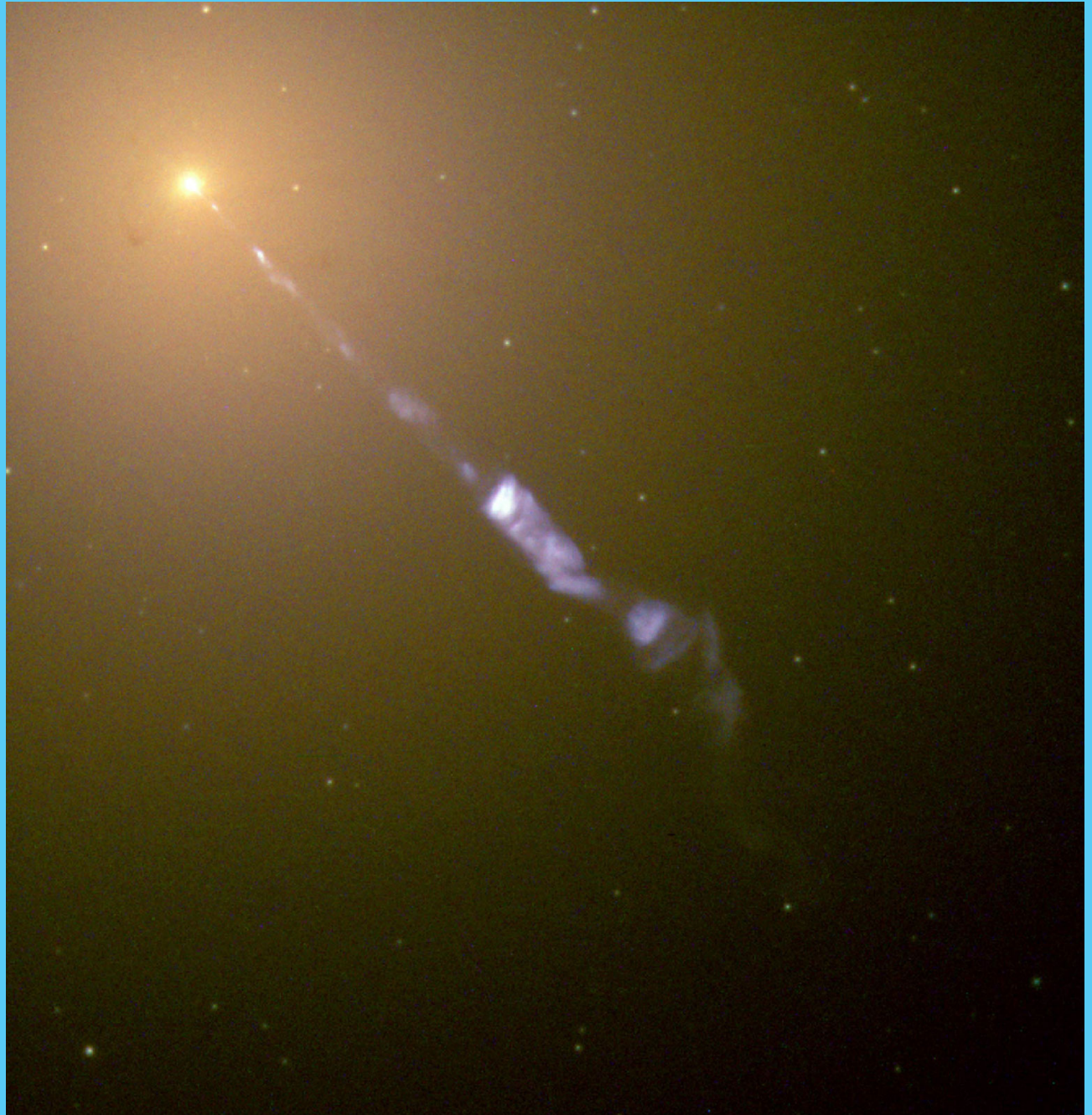


# Composite visible ir image





# Virgo-A jet



# Planetary Nebula

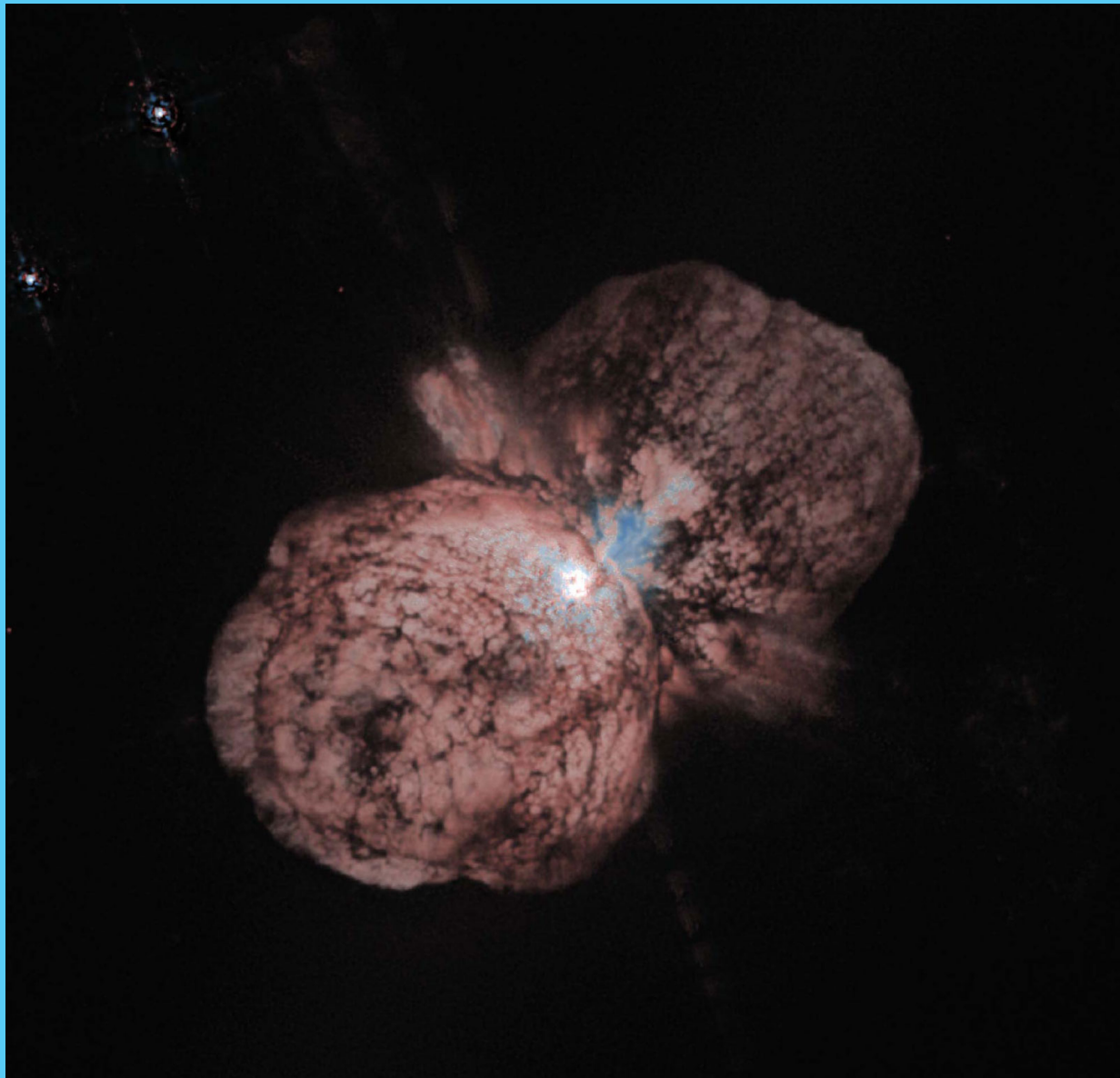
8 kly

Wind from aging star





# Eta-carina





# Orion nebula; a stellar nursery



[https://www.nasa.gov/mission\\_pages/hubble/videos/index.html](https://www.nasa.gov/mission_pages/hubble/videos/index.html)

3/26/ Flight Through the Orion Nebula in Visible and Infrared Light

## Flight Through the Orion Nebula in Visible and Infrared Light





# A famous HST image: M16, Eagle Nebula.





# Eagle Nebula: Spitzer and X-ray



# Eagle Nebula