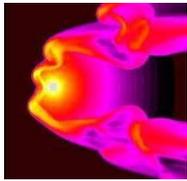


# The future of our Sun

---



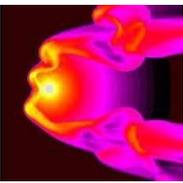
**Dr Chris Wareing**  
**University of Leeds**



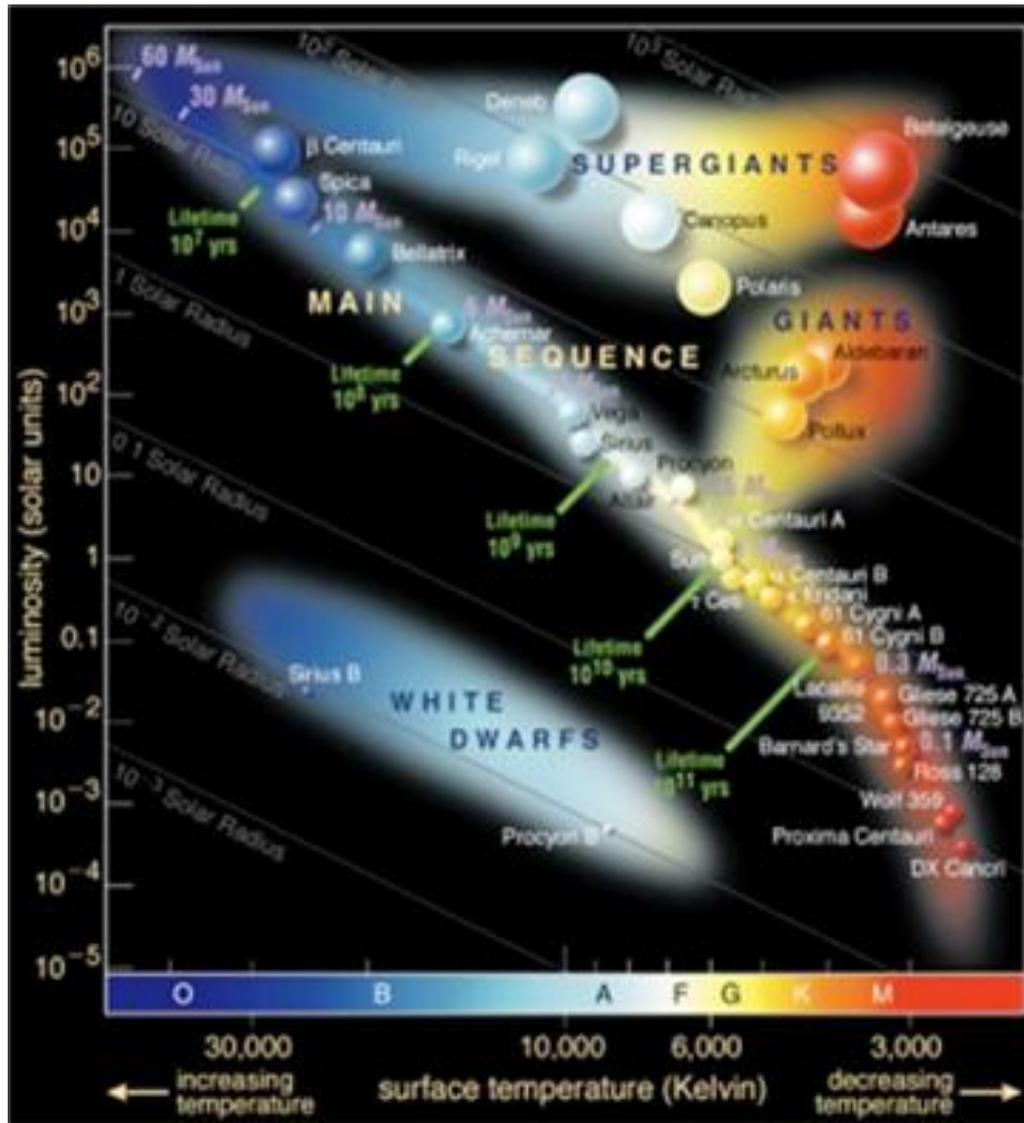
# Overview

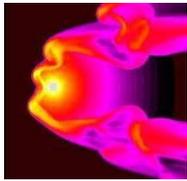
---

- Where's our Sun going in life?
- Modelling evolved stars:-
  - planetary nebula and their progenitors
  - mira stars
  - neutron stars



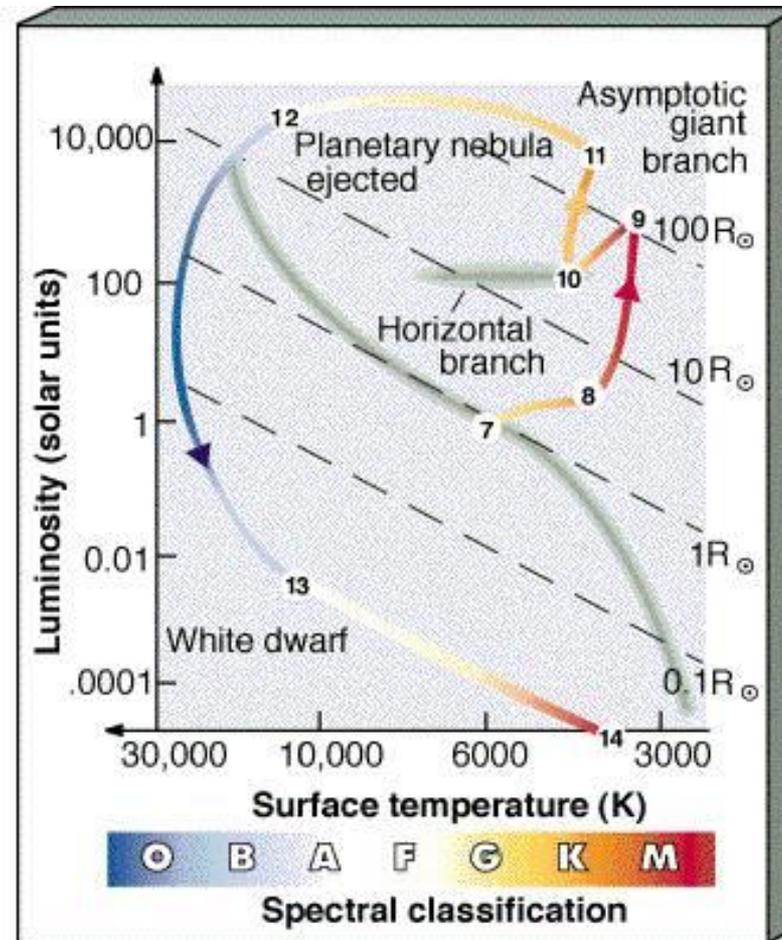
# Where are we now...

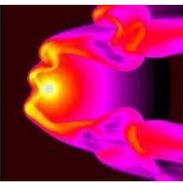




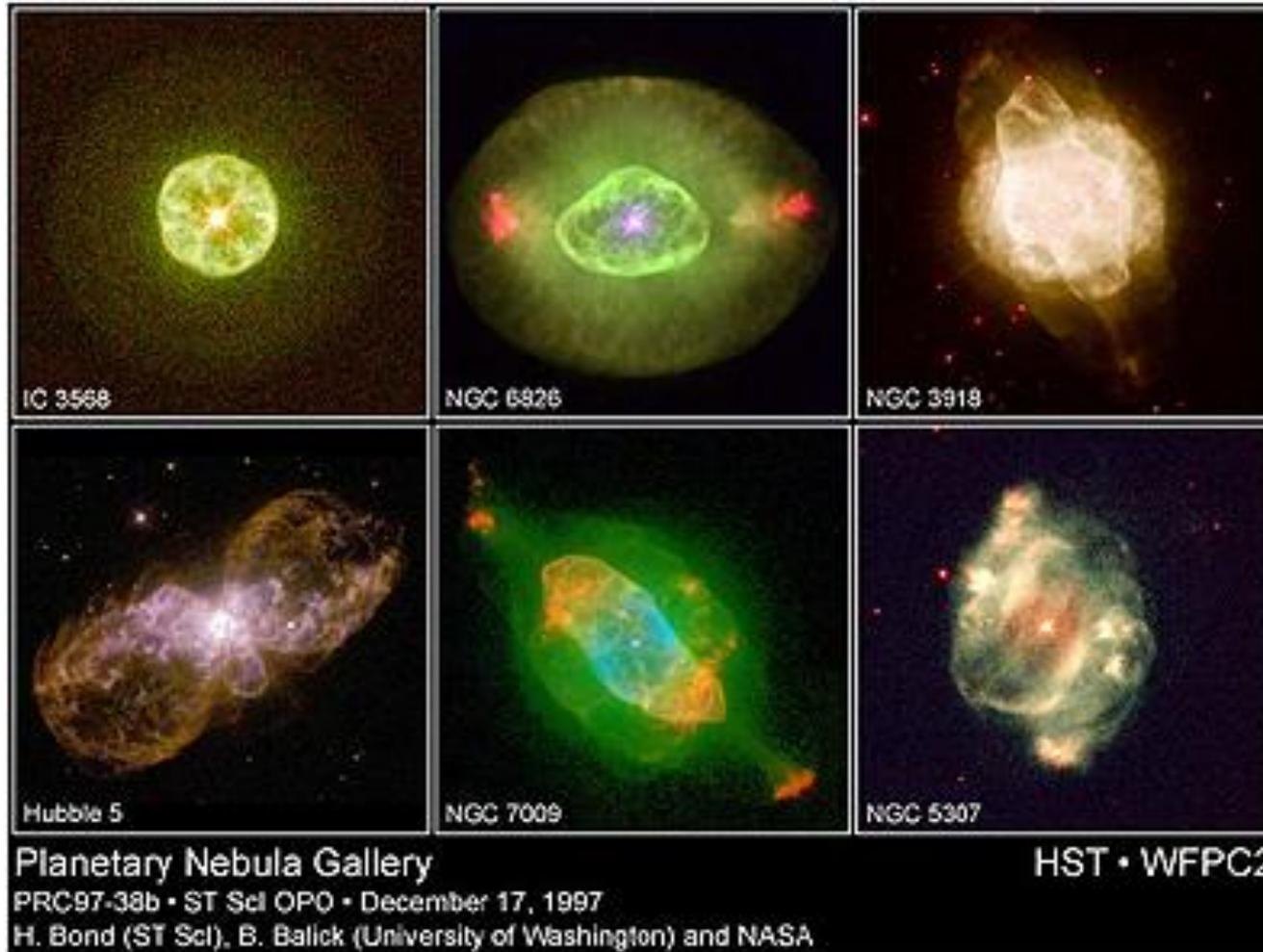
# ...and where are we going?

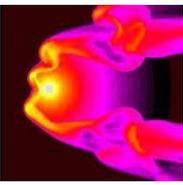
To answer any of these questions, we must study planetary nebulae





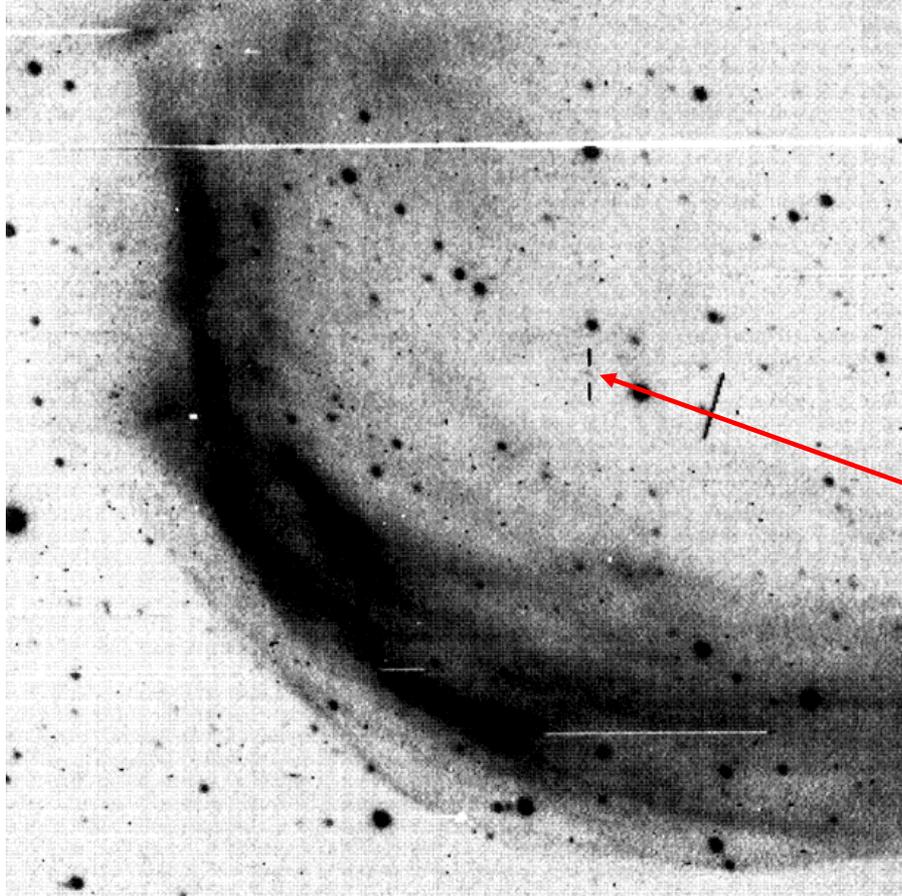
# A gallery of planetary nebulae



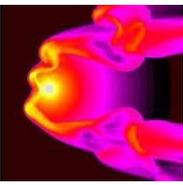


# The planetary nebula Sh 2-188

---



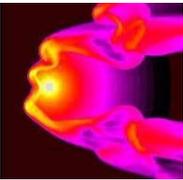
- Filamentary one-sided nebula.
- Central star candidate.



# Sh 2-188: new observations

---



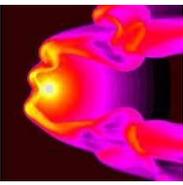


# Computer simulations

---

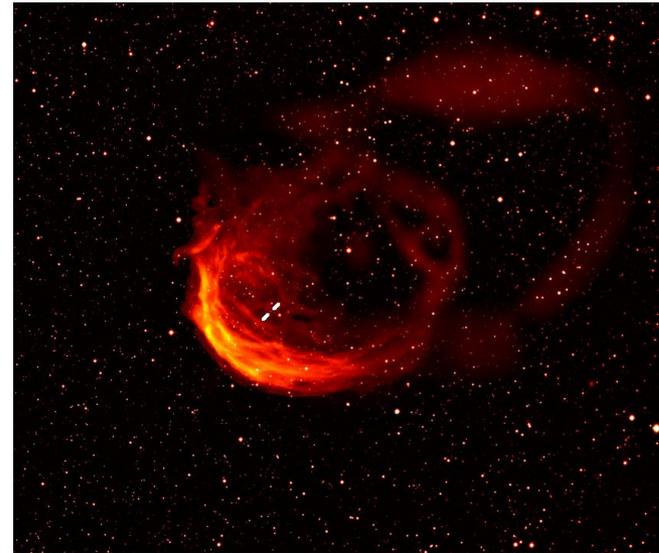
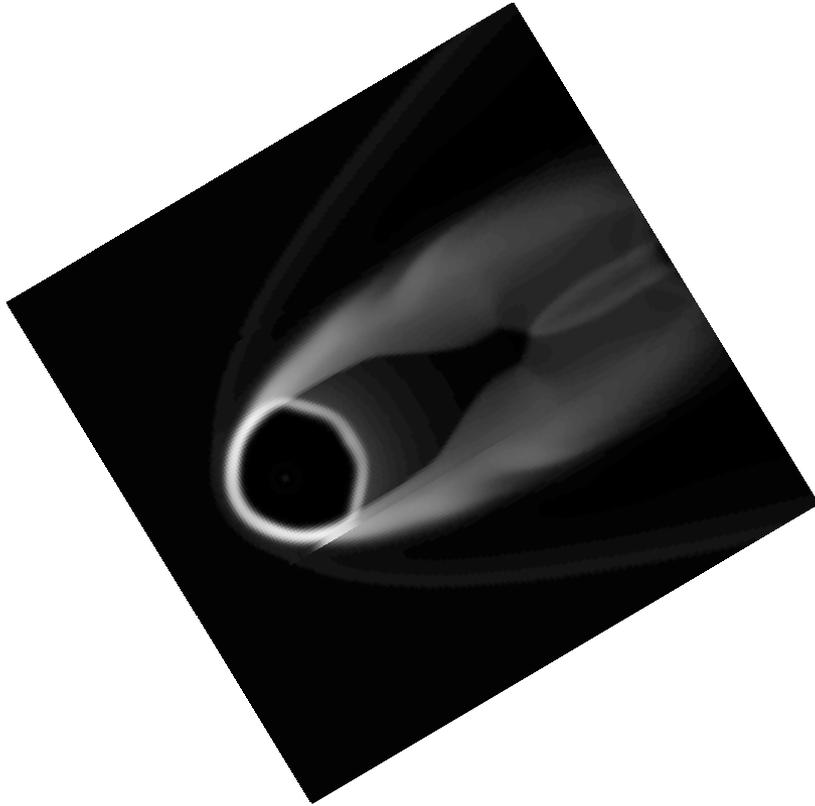
- space isn't empty, albeit very close.
- we simulate space as a very low density fluid
- the equations for the motion of fluids are well known (if still unsolved!)
- we use an approximation and a model like a boat passing through water; we move a star through the fluid

*N.B. – there are 5 times more frames per unit time during the post-AGB phase*

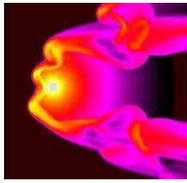


# Sh 2-188: post-AGB evolution

---



Best fit of model implies a velocity of 125 km/s

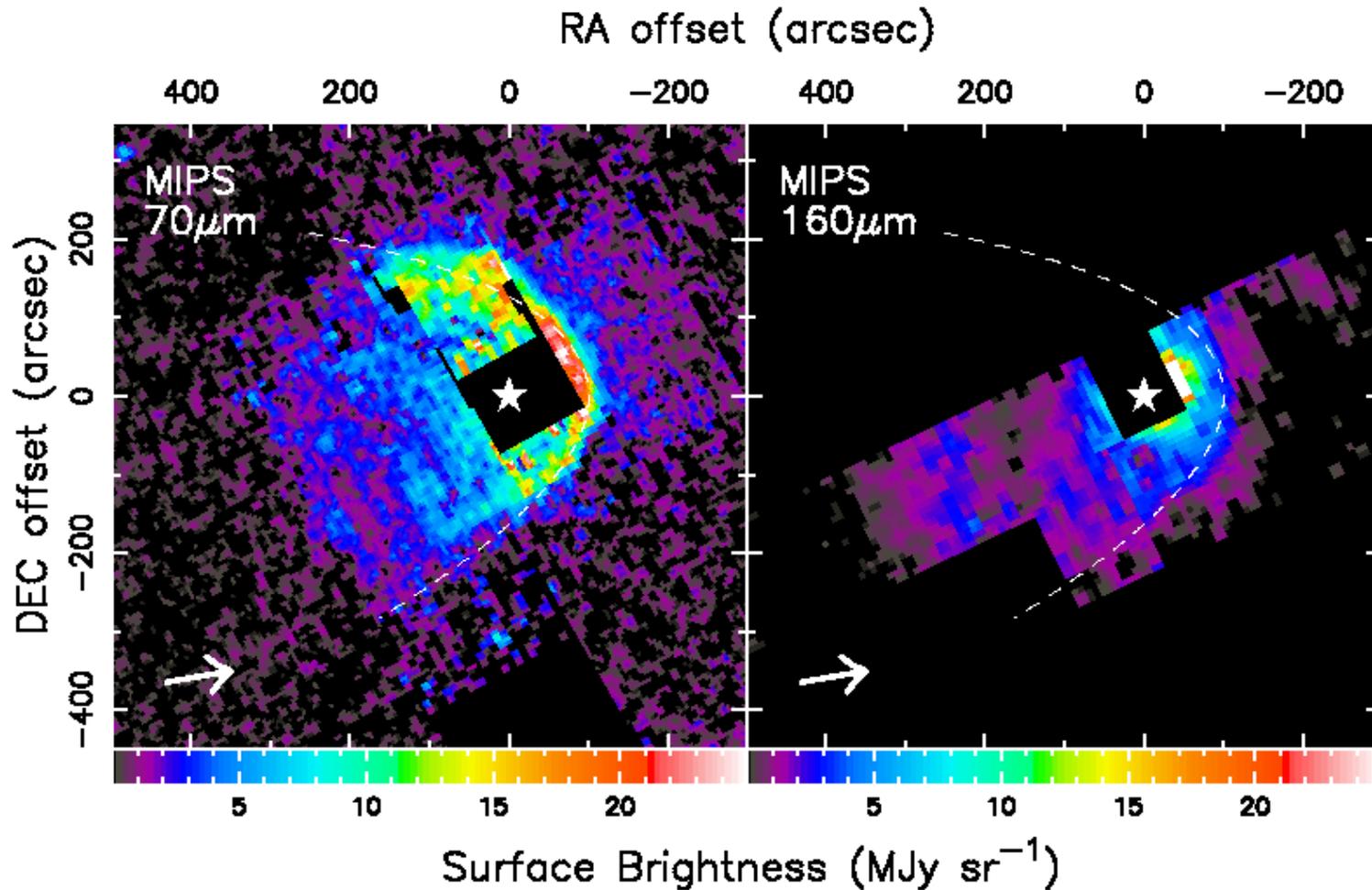
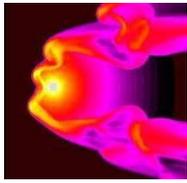


# Prediction

---

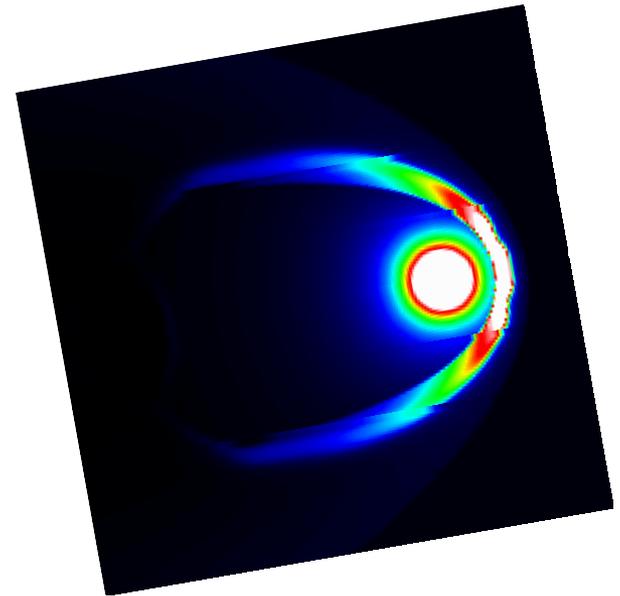
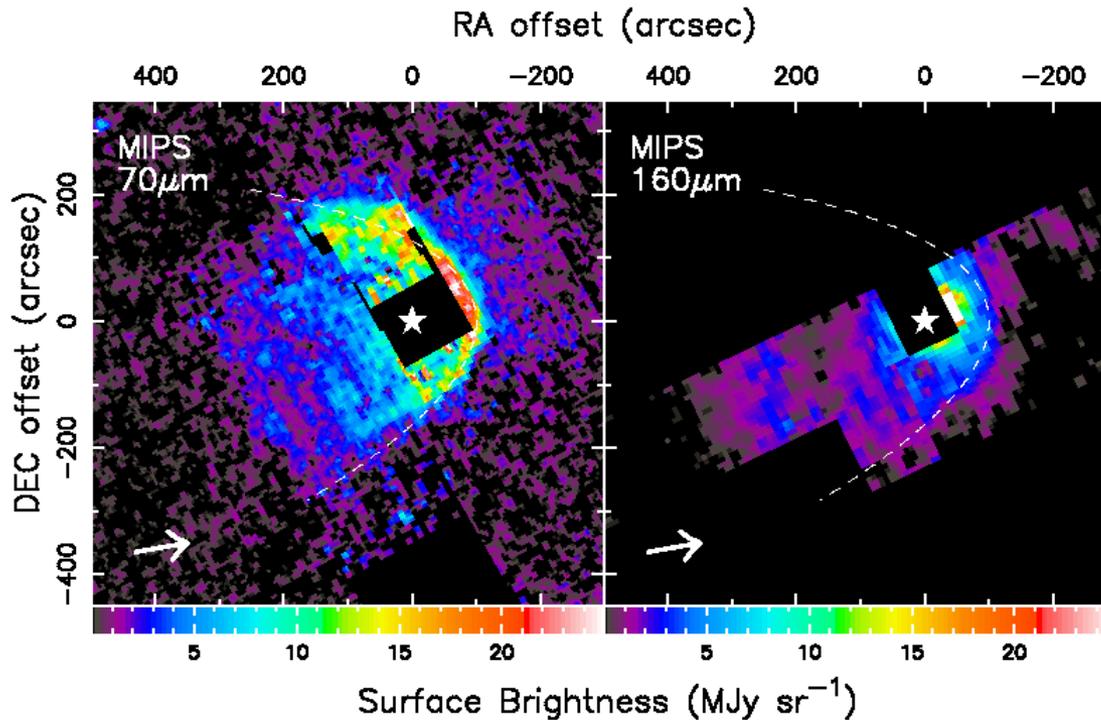
There must exist bow shocks around the progenitors of planetary nebulae.

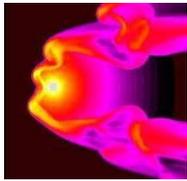
# New observations of R Hydrae



# New observations of R Hydrae

Motion of the star is in the right direction for the arc-like structure ahead of the star being a bow shock.

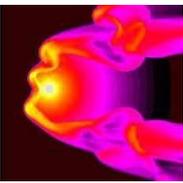




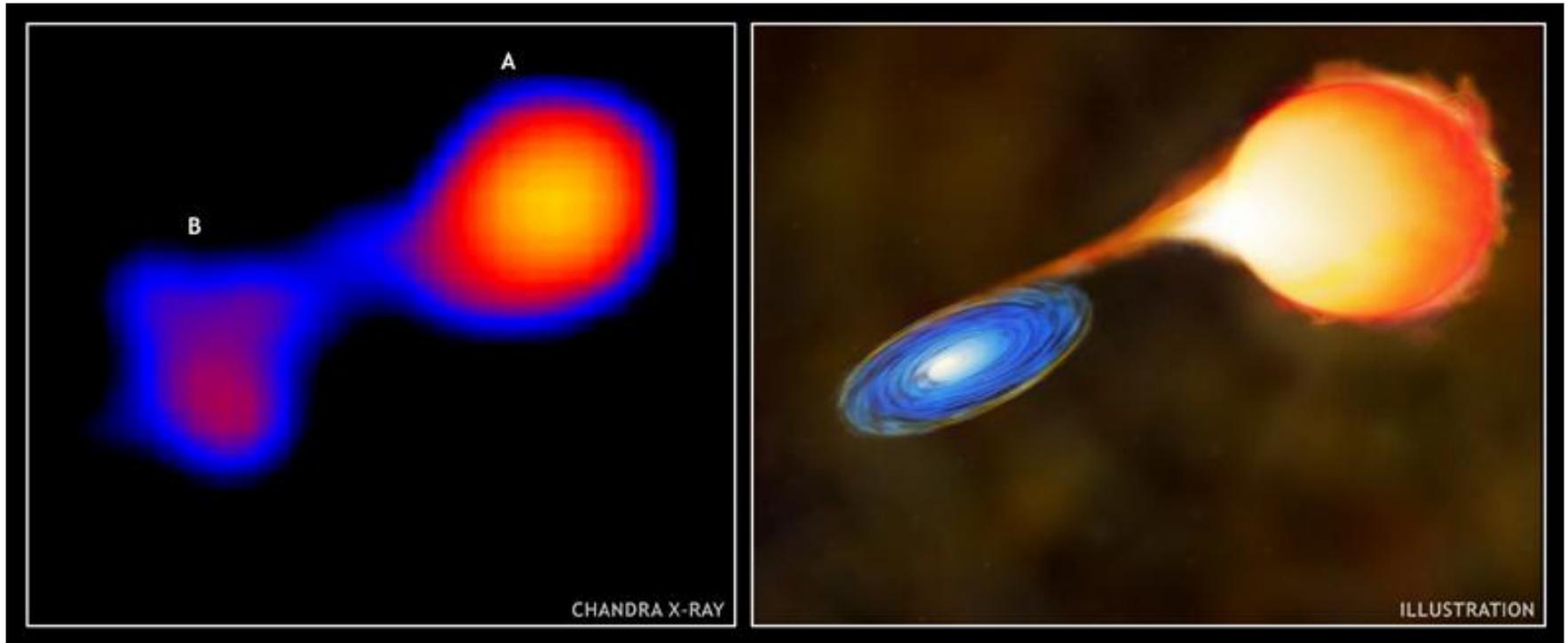
# Prediction 3

---

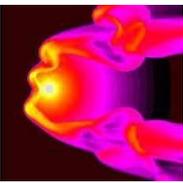
If bow shocks exists around the progenitors of planetary nebulae, tails of material must also exist.



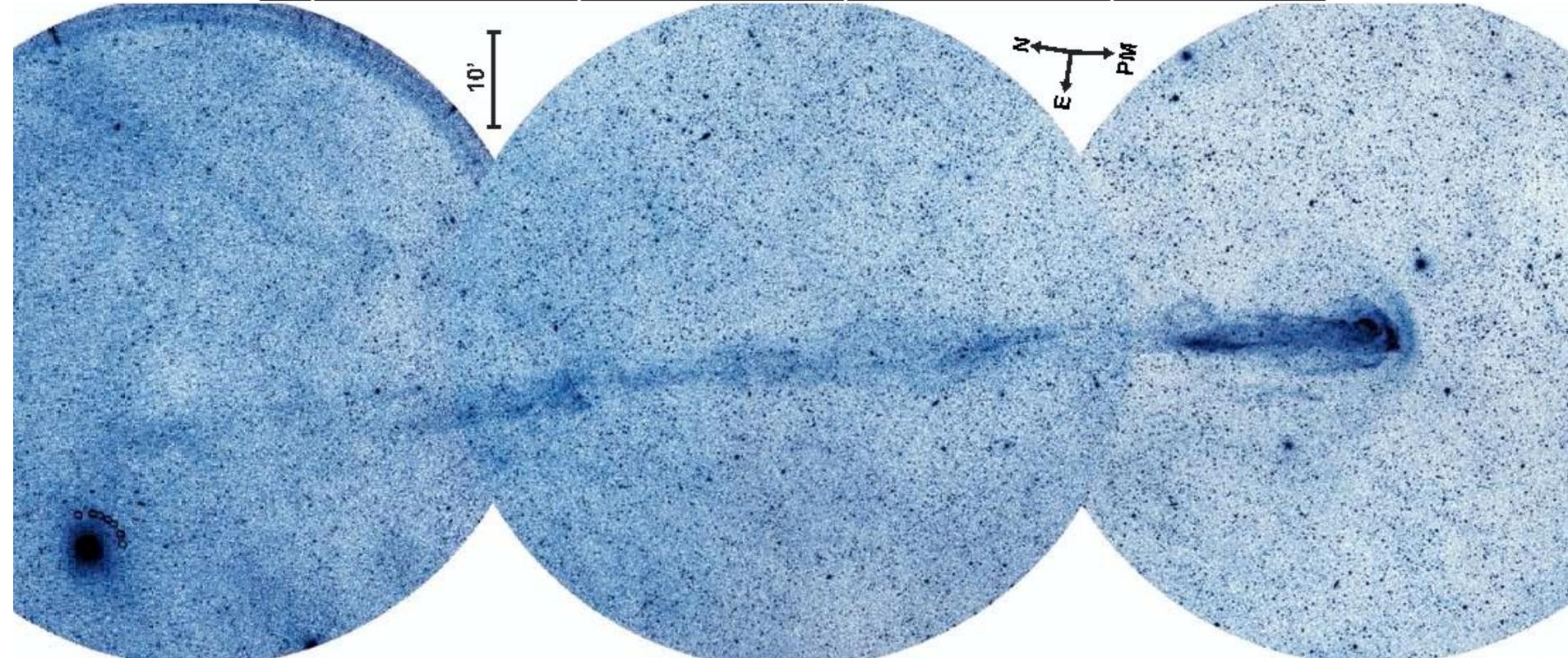
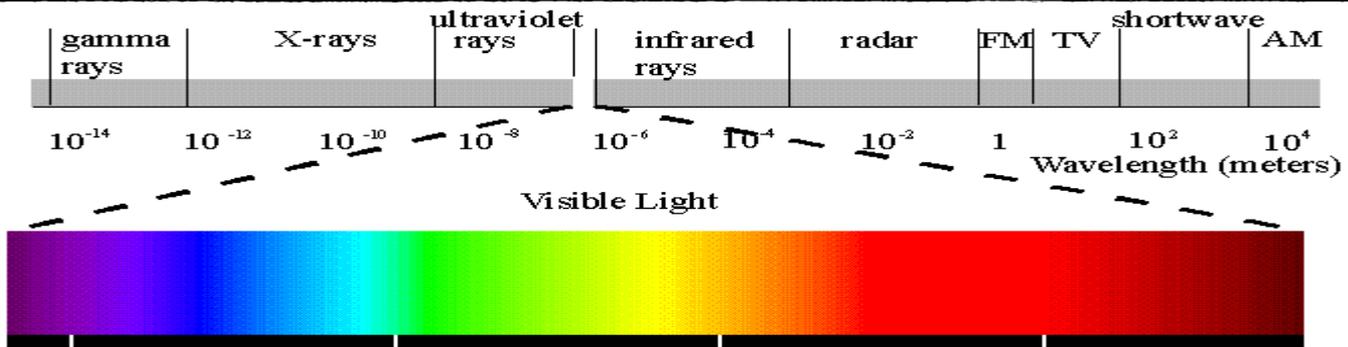
# The binary star system Mira

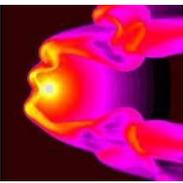


- Mira A: planetary nebulae progenitor.
- Mira B: possibly a white dwarf.



# Ultra-violet observation





# Ultra-violet vs. visible light

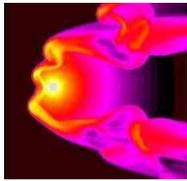
---



UV



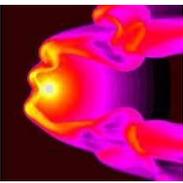
Visible light



# Mira

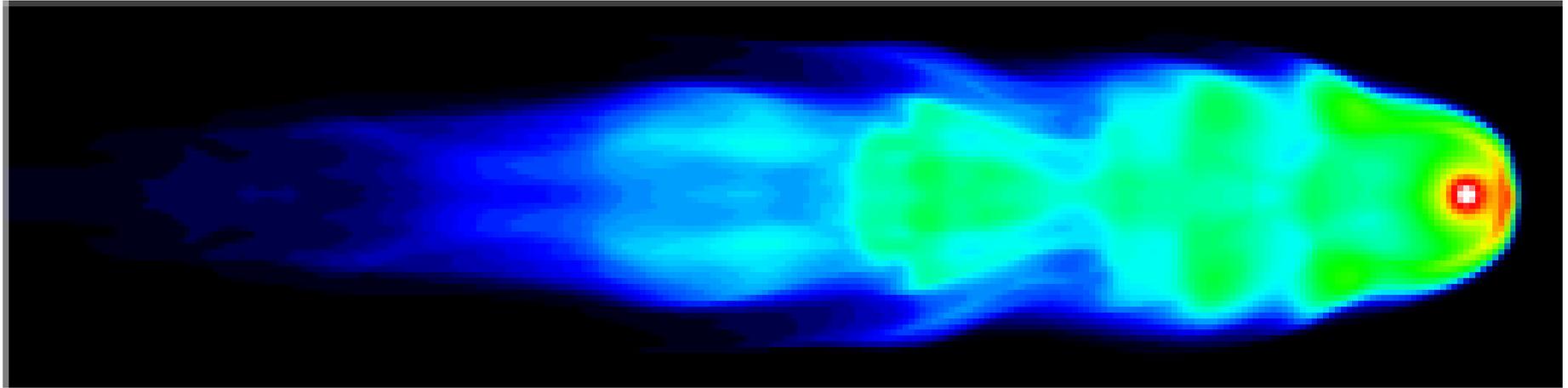
---

An animation of Mira's movement through the ISM  
Credit: NASA/JPL-Caltech

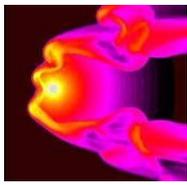


# Simulations

---



450,000 years to form a 4pc tail!

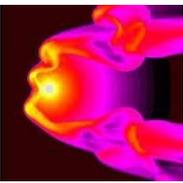


---

But what might happen to our Earth when the Sun goes through this stage of evolution?

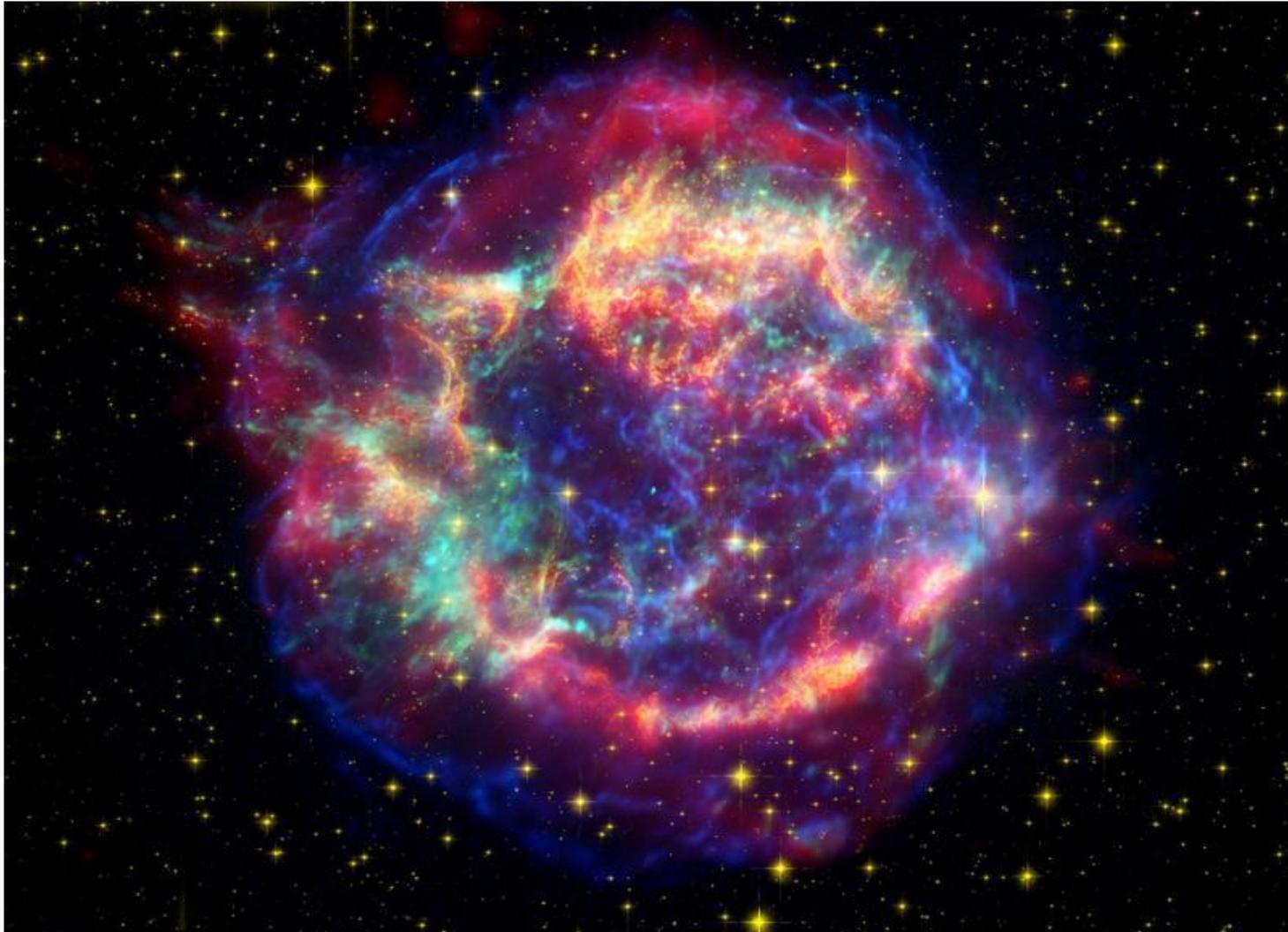
The short answer is complete destruction!

But this won't happen for another 5 billion years, so no need to worry just yet.



# Supernovae

---



# Neutron stars

