

# Astro I: Introductory Astronomy



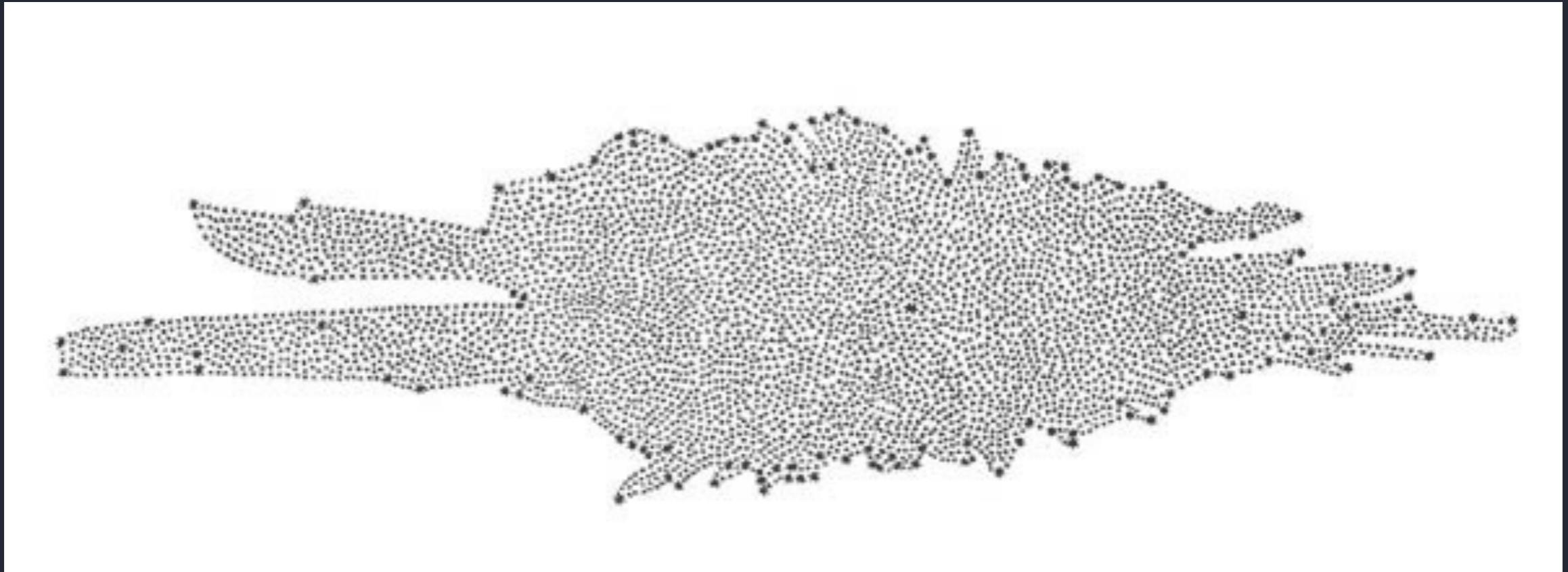




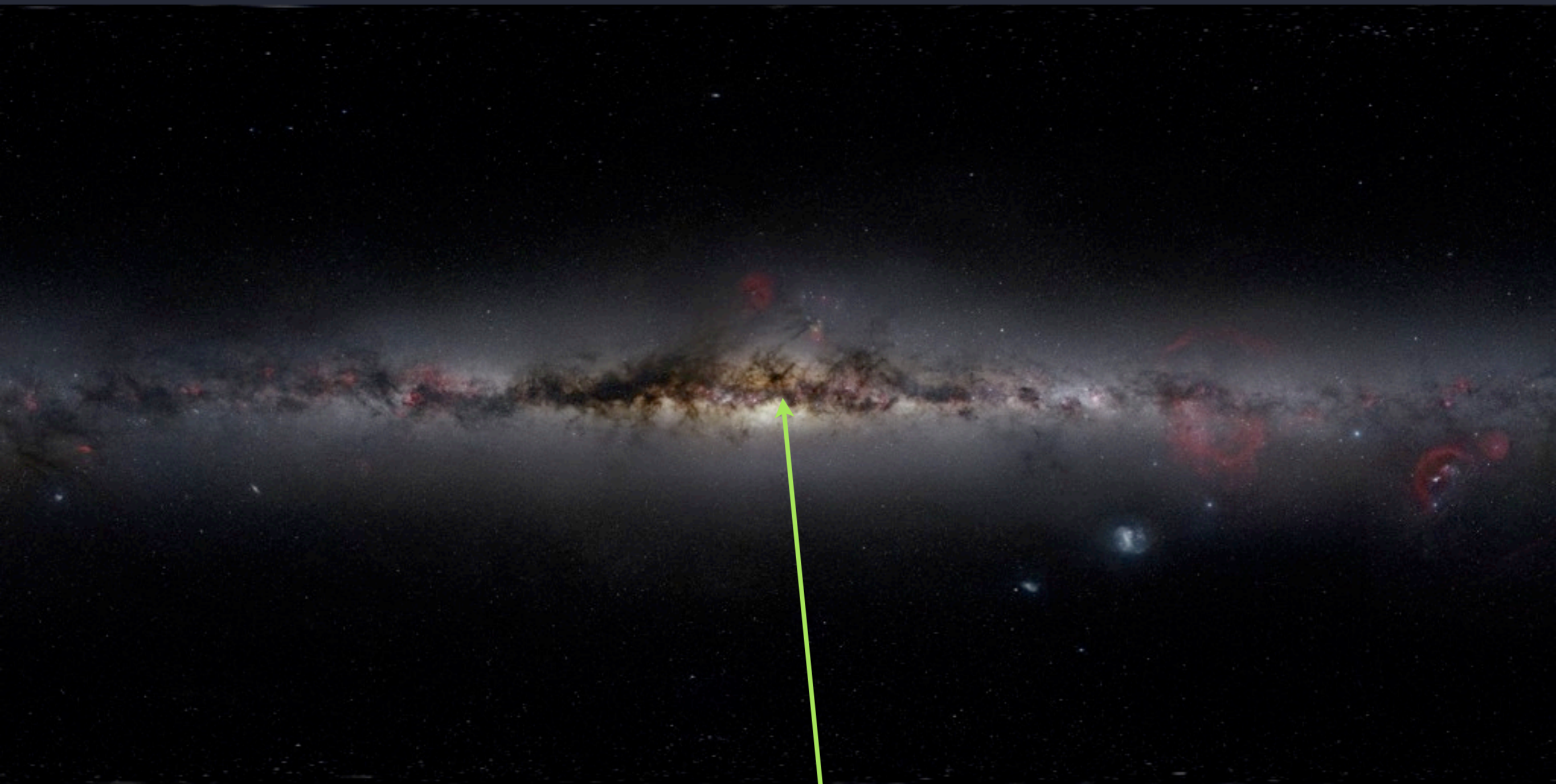
<http://apod.nasa.gov/apod/ap130429.html>



# 1757 based on star counts in different directions William and Caroline Herschel



They didn't recognize that dust was absorbing the light from more distant stars, so their estimate of the Galaxy's size was too small, and they also therefore incorrectly thought that we were close to the center.



<http://apod.nasa.gov/apod/ap110520.html>

Galactic center

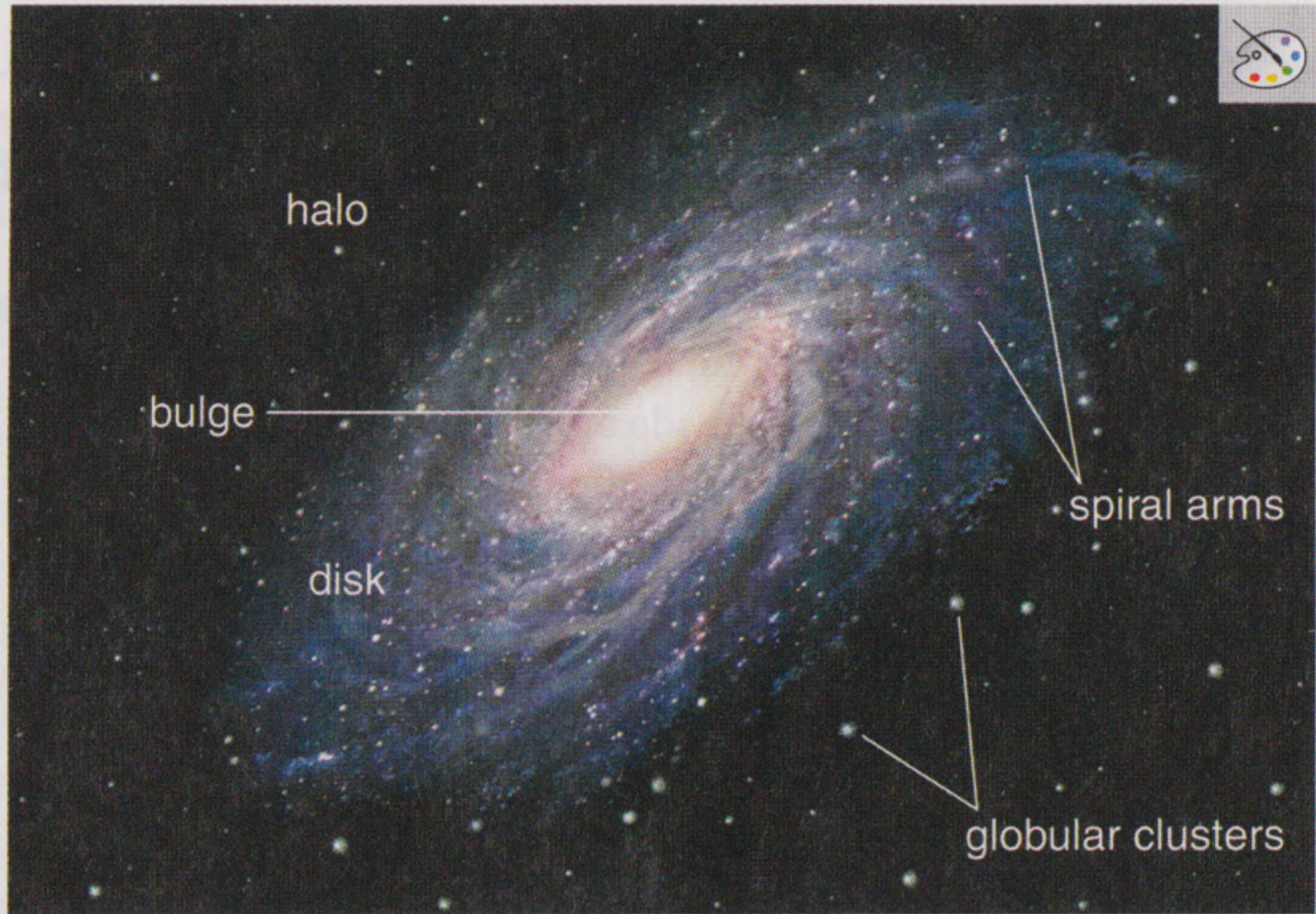


Globular clusters are distributed symmetrically around the center of the Milky Way...and the Solar System is clearly off to one side of the distribution



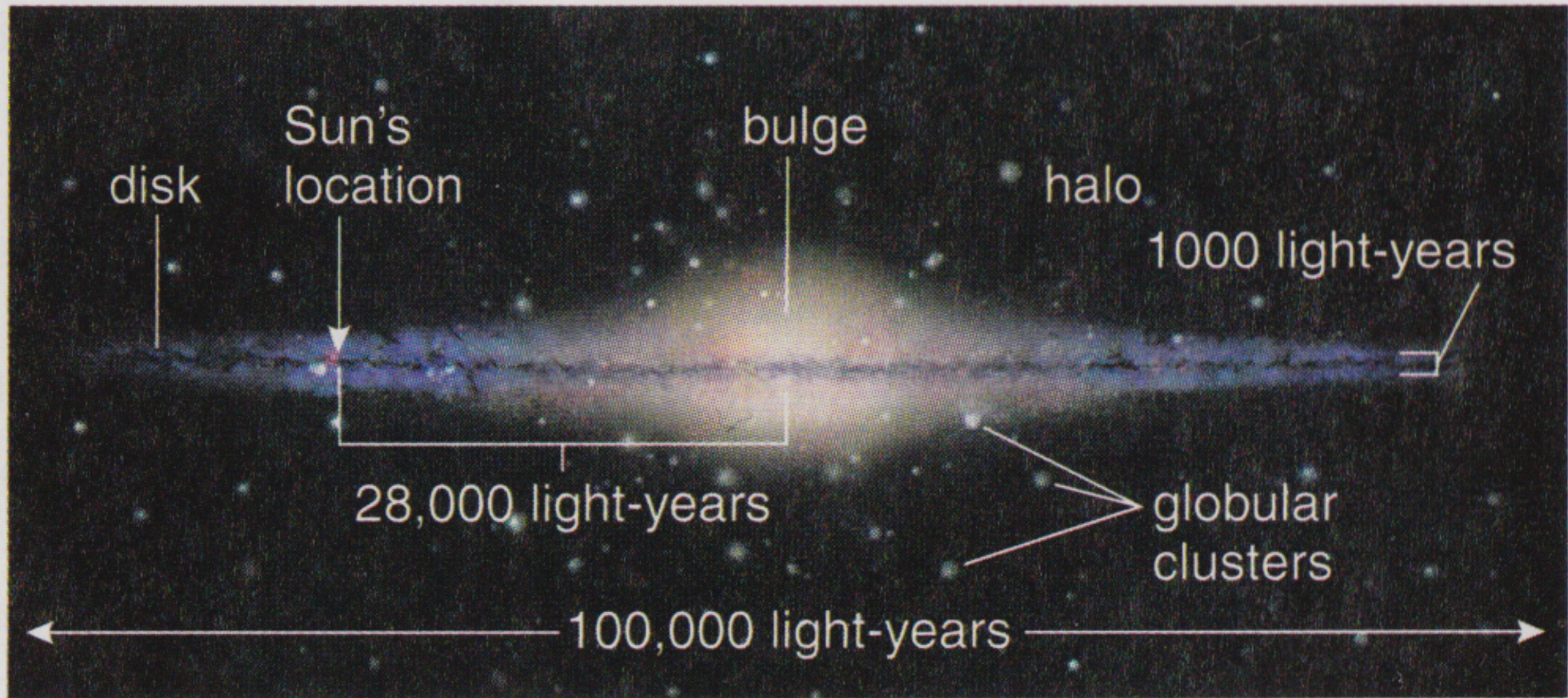


# A coherent picture of the Milky Way emerged by the mid-20th Century



a Artist's conception of the Milky Way viewed from the outside.

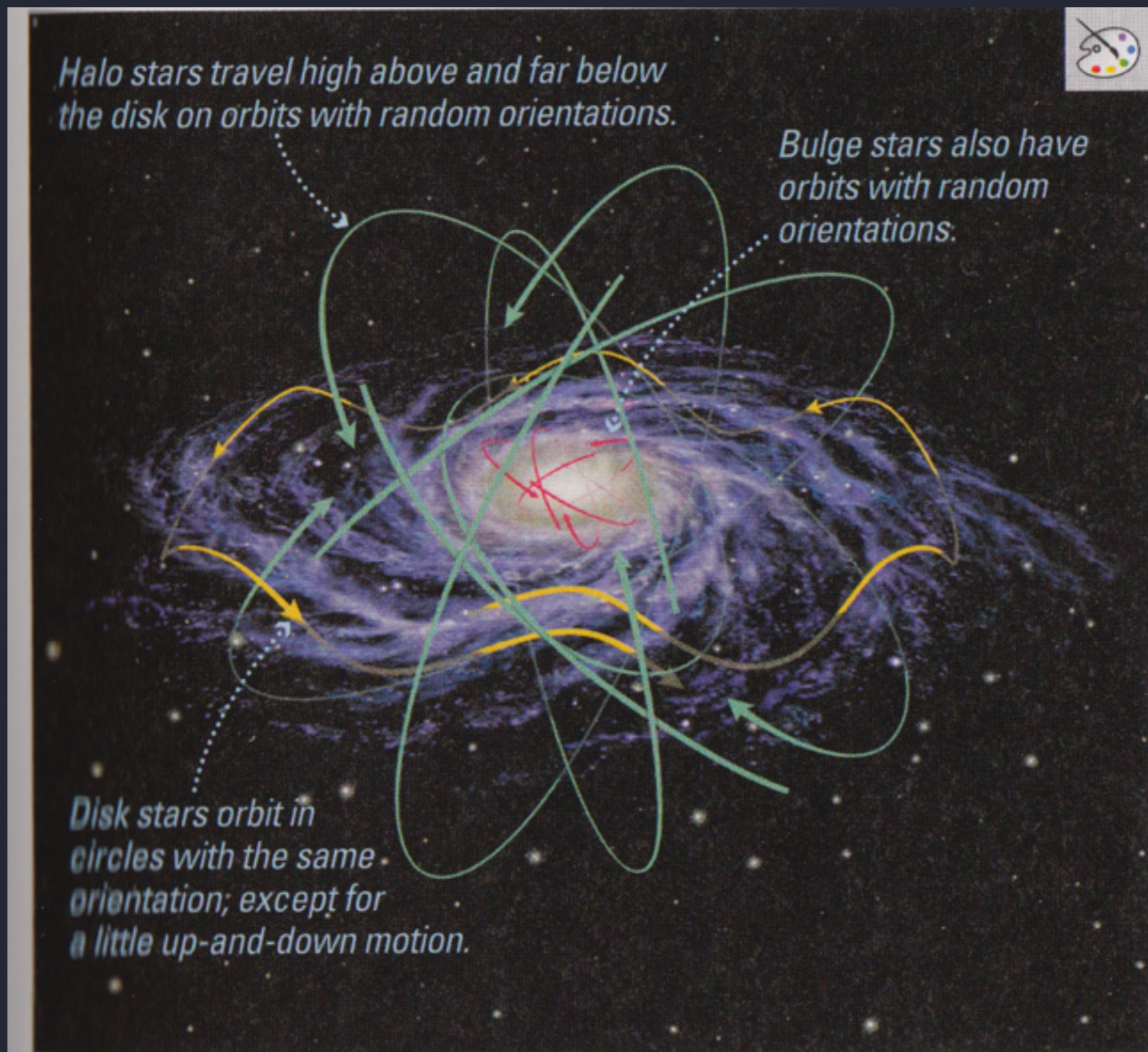




**b** Edge-on schematic view of the Milky Way.



# Disk and Halo stars have different sorts of orbits



**FIGURE 19.2** Characteristic orbits of disk stars (yellow), bulge stars (red), and halo stars (green) around the galactic center. (The yellow path exaggerates the up-and-down motion of the disk star orbits.)





<http://apod.nasa.gov/apod/ap130416.html>





<http://apod.nasa.gov/apod/ap110520.html>



# stellar wind bubble - returning gas to the interstellar medium (ISM)



<http://apod.nasa.gov/apod/ap080813.html>





<http://apod.nasa.gov/apod/ap061018.html>

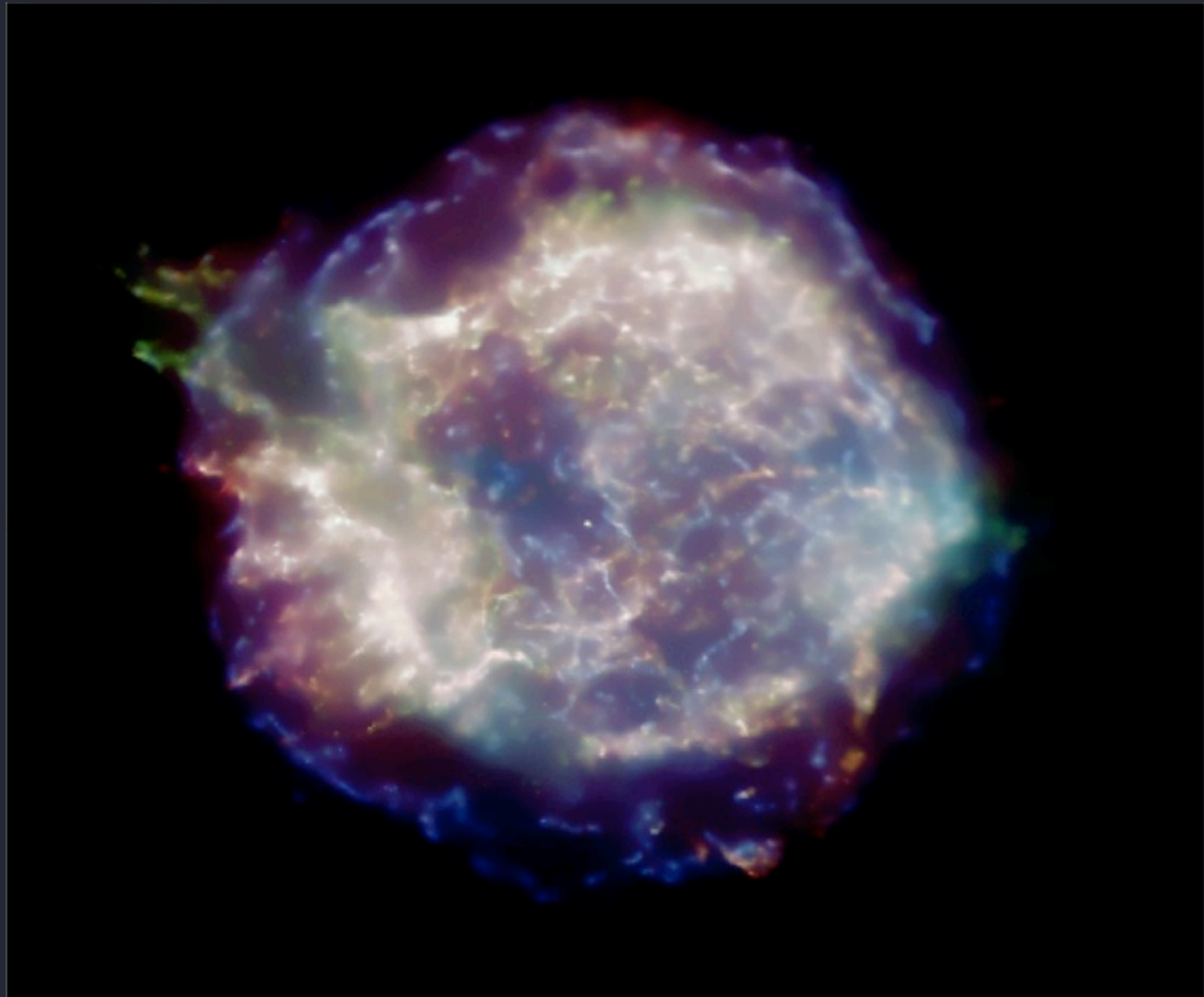


# A “planetary nebula” - death of a low-mass star



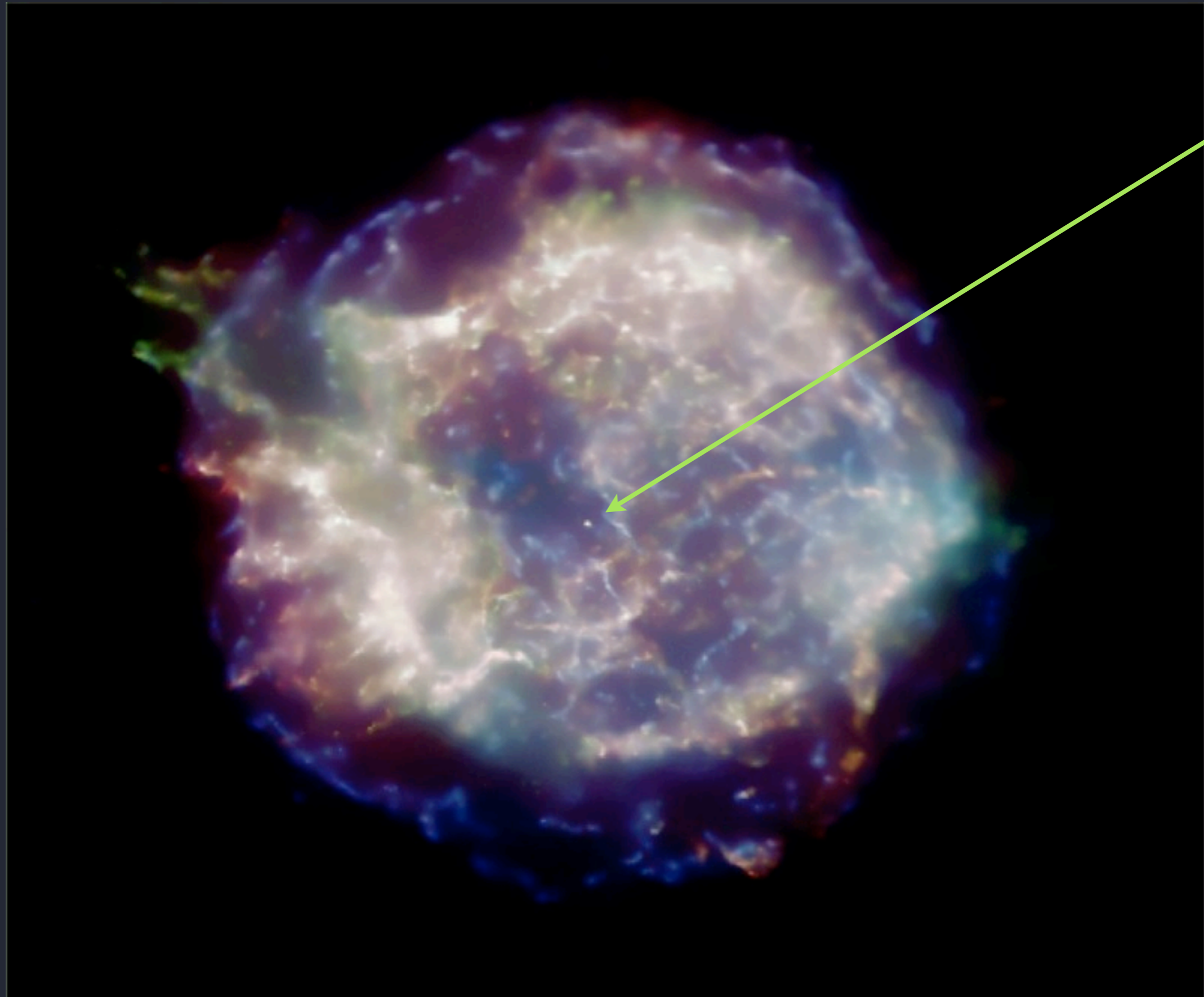


Supernova also return metal-rich gas to the ISM - it starts out hot, here in X-rays



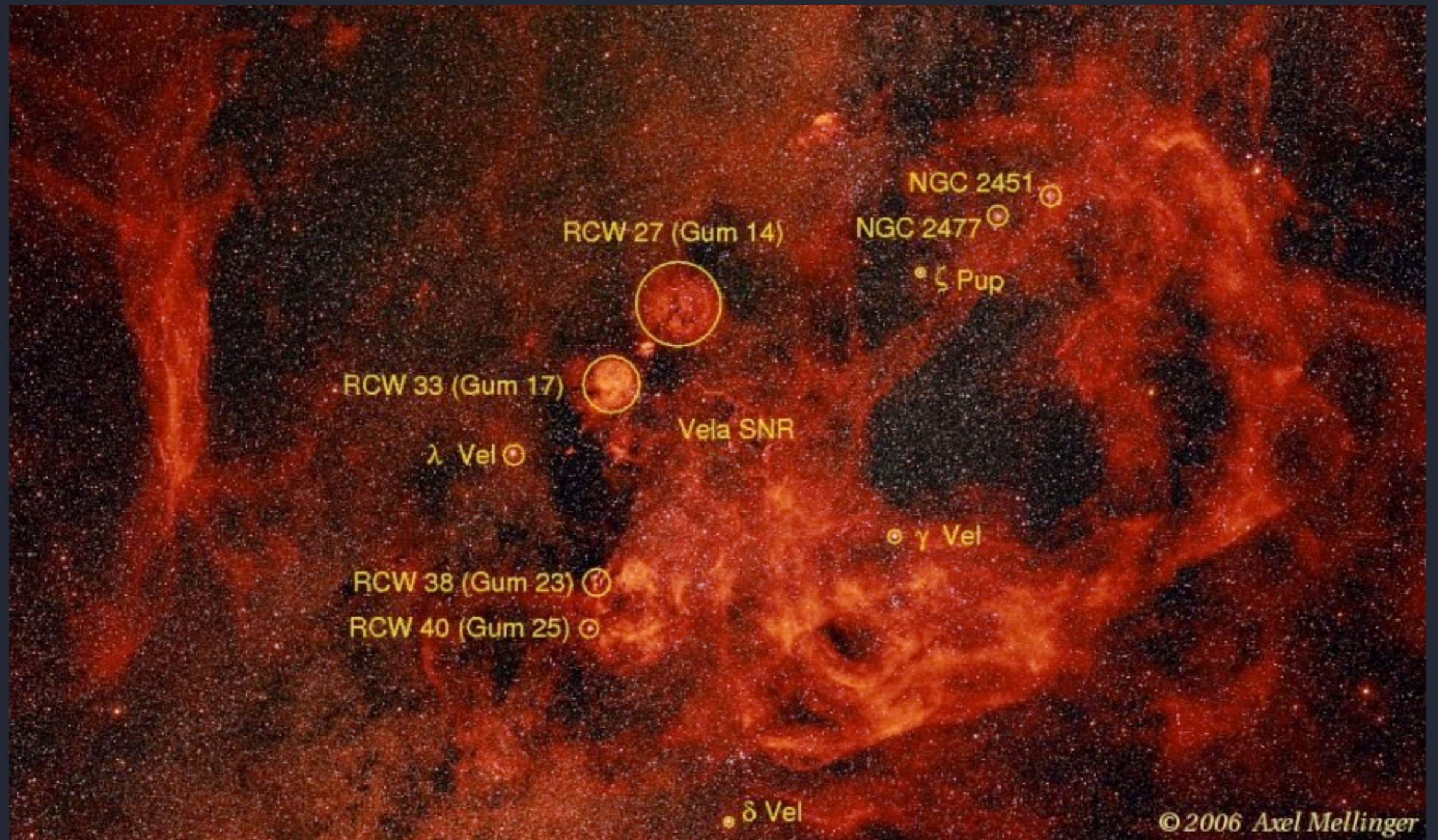


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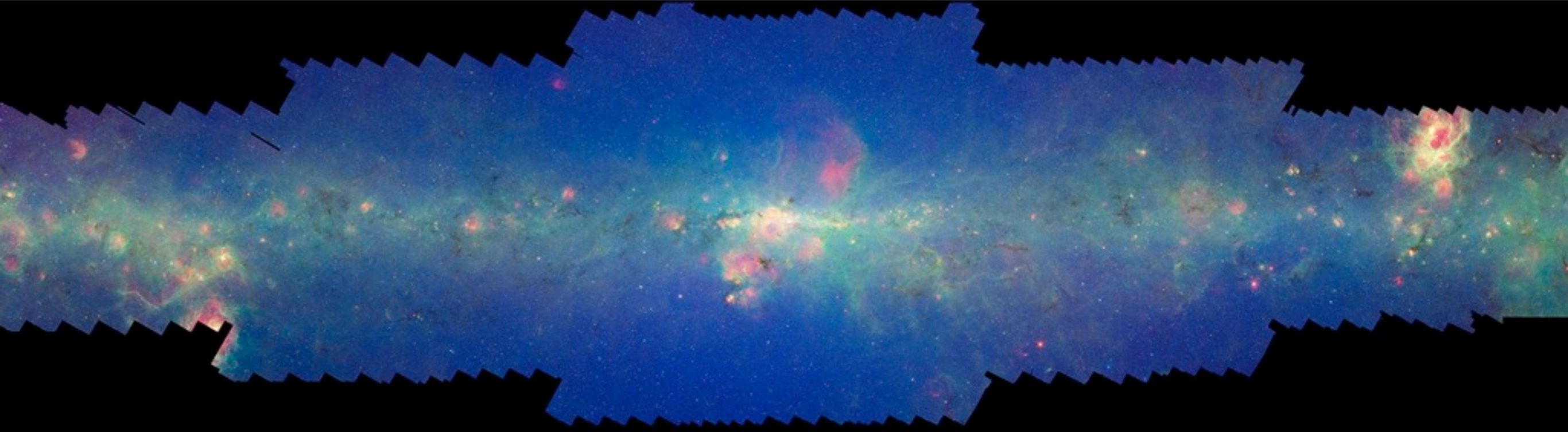
Supernova remnants age...and fade into the interstellar medium, eventually cooling and becoming regular interstellar clouds...but enriched in heavy elements



<http://apod.nasa.gov/apod/ap060519.html>



# Infrared Milky Way



<http://apod.nasa.gov/apod/ap080605.html>

Green-coded wavelengths are from PAHs (polycyclic aromatic hydrocarbons)  
Red-coded wavelengths are from dust warmed by starlight

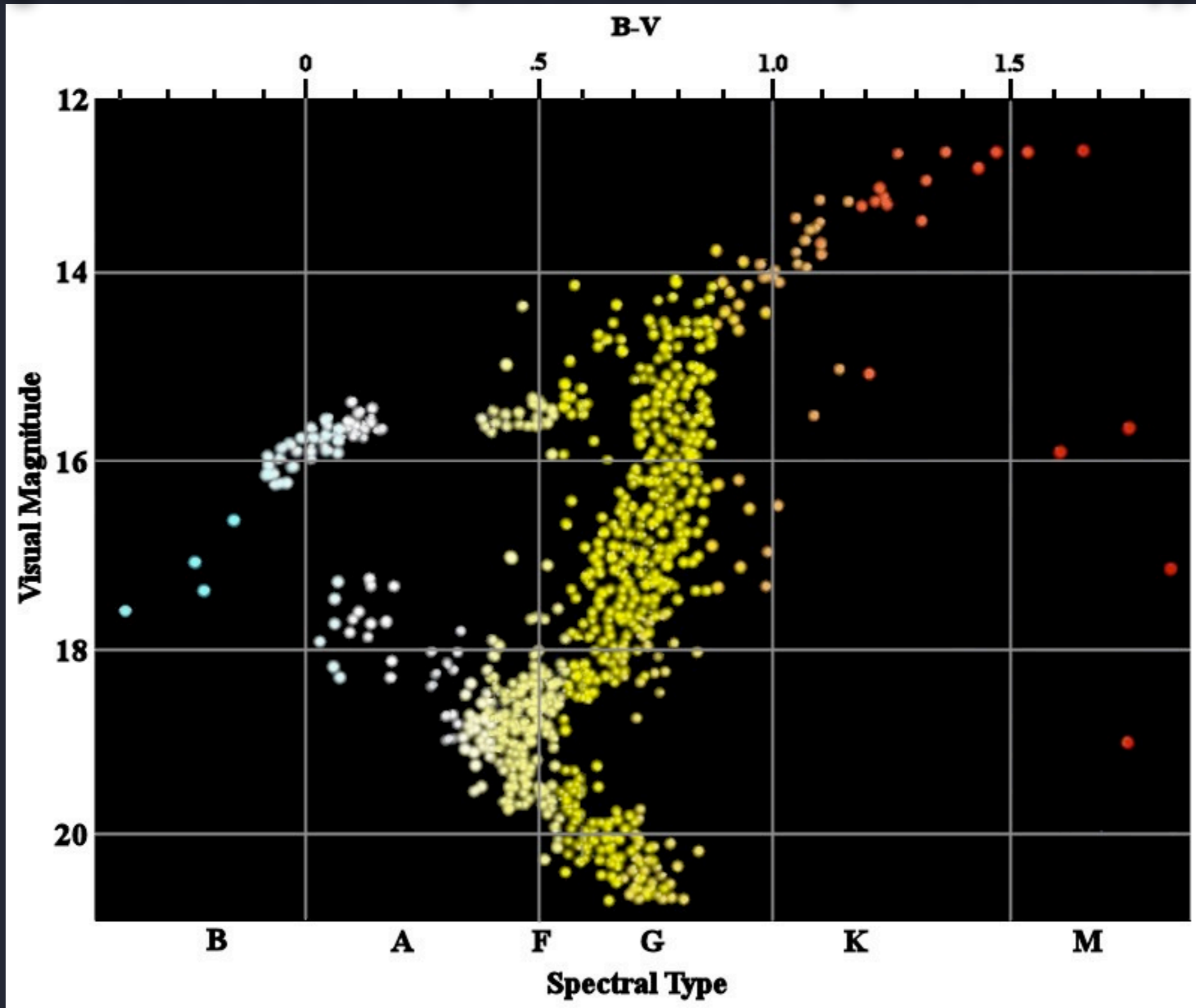


# How do we know globular clusters are old?



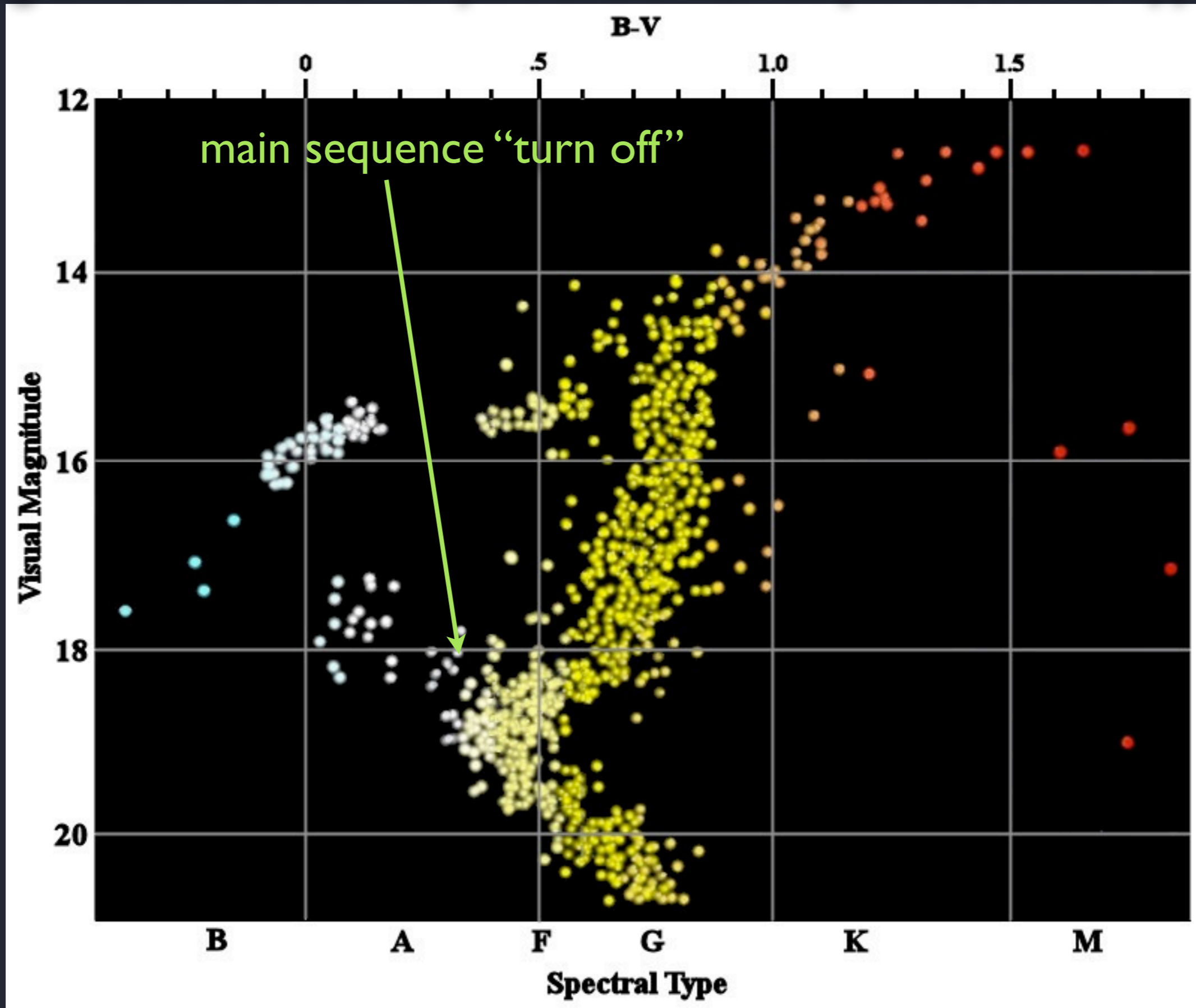


HR diagram shows the lower part of the main sequence, but no upper part



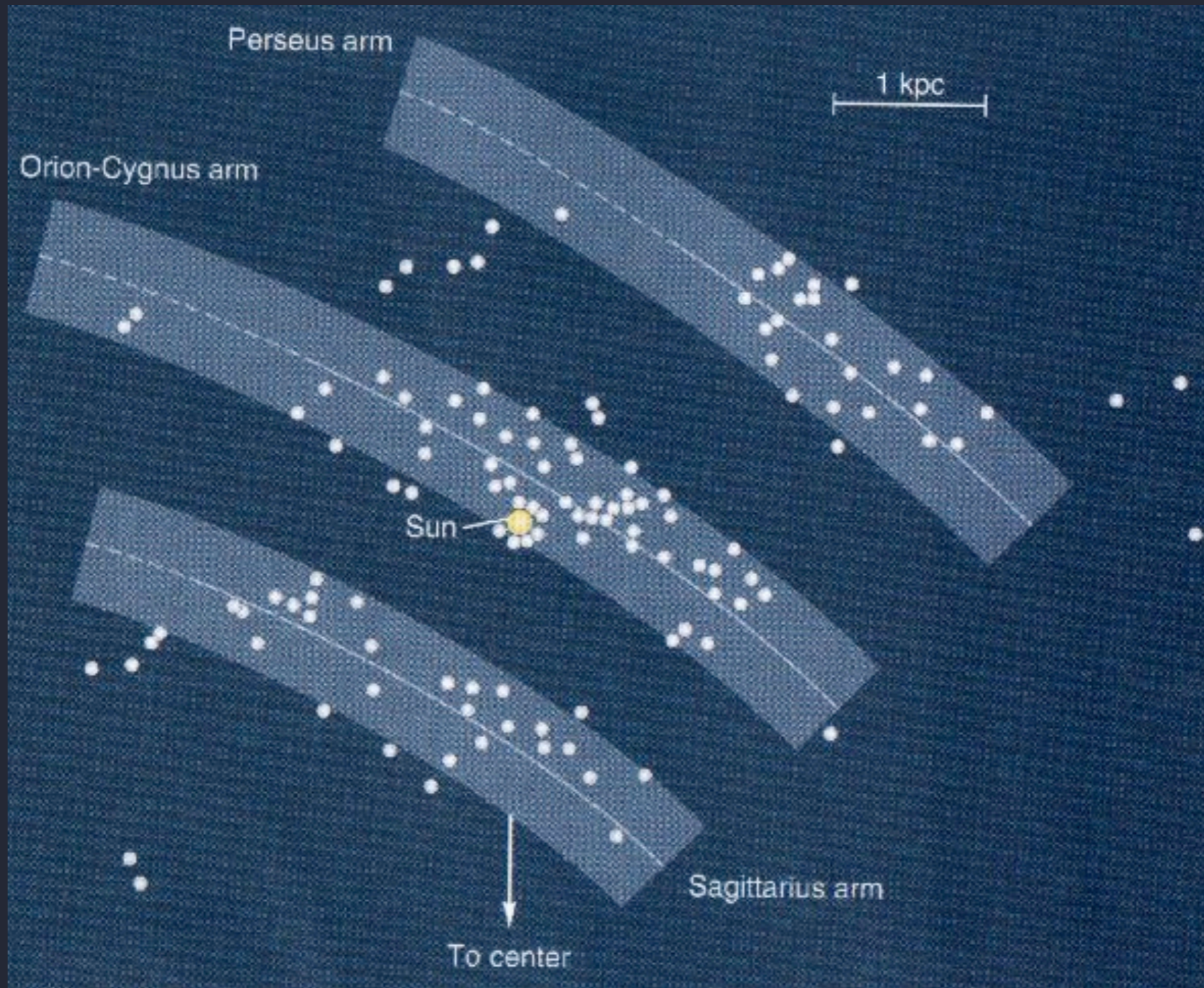


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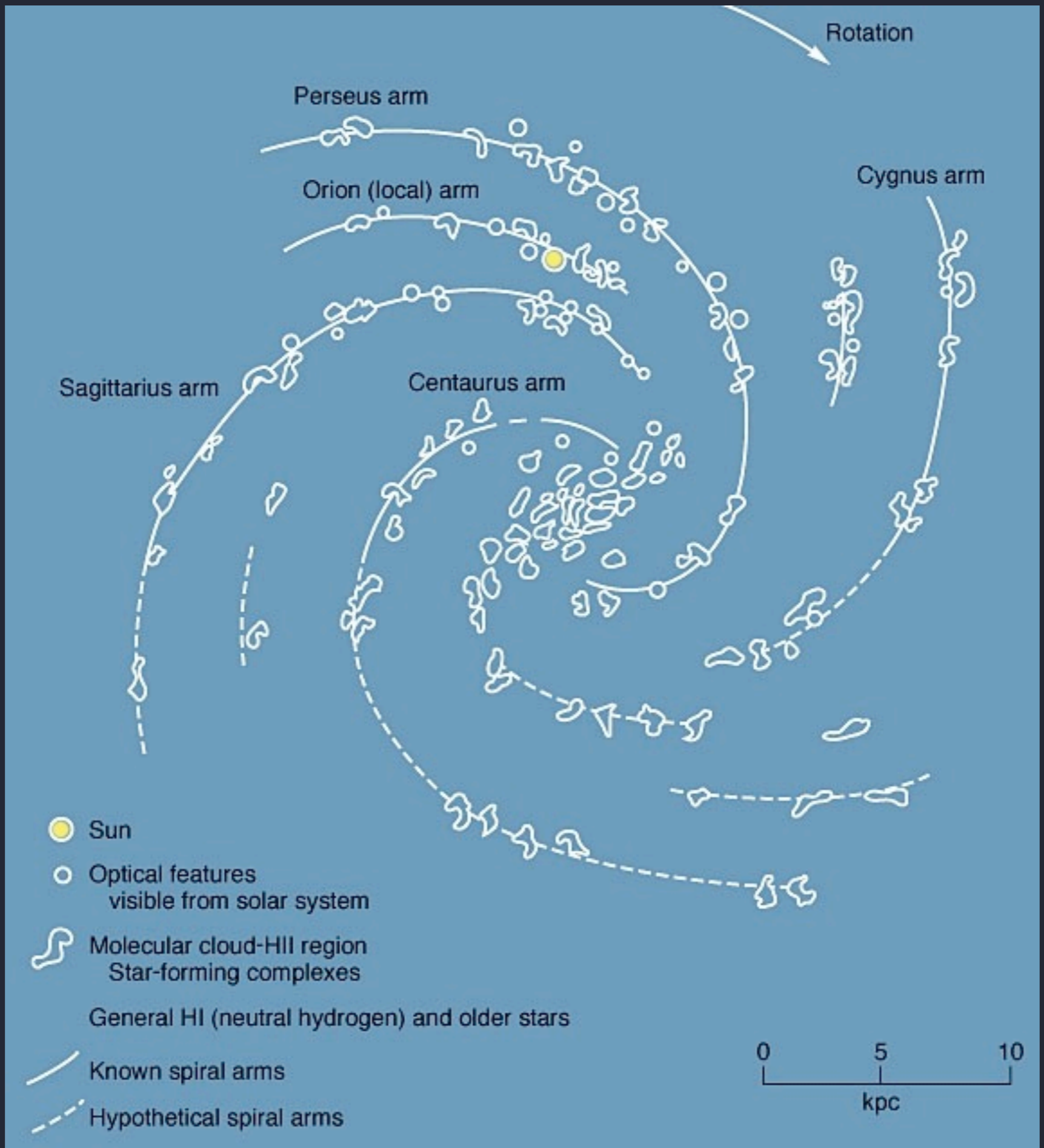




Spiral structure: very luminous stars and gas clouds tend to occur in spiral arms









H II regions (H “two” indicating ionized hydrogen)





# The Orion Nebula is an H II region





Spiral arms are where most of the gas, dust, and young massive stars are

