

Sun

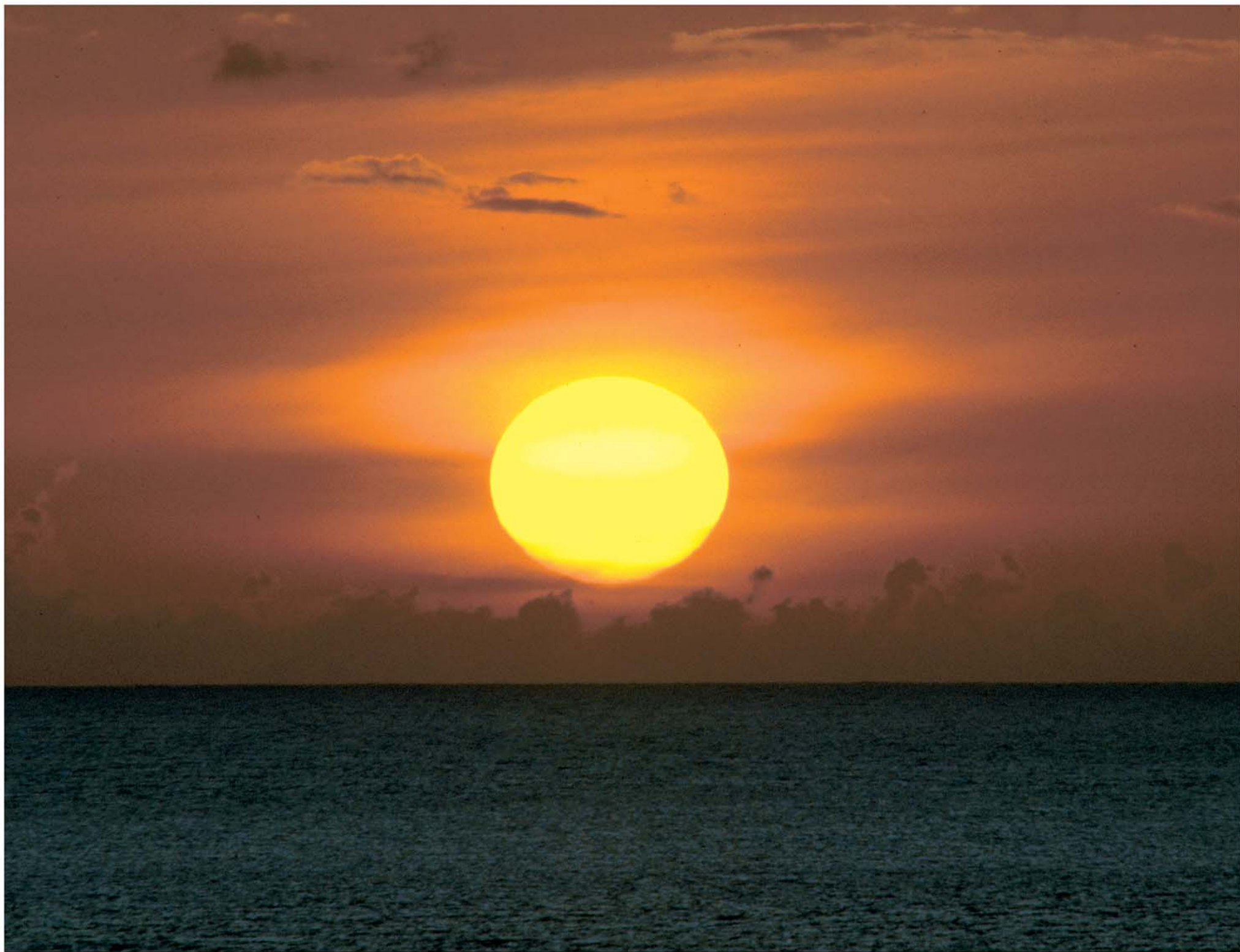
Stars

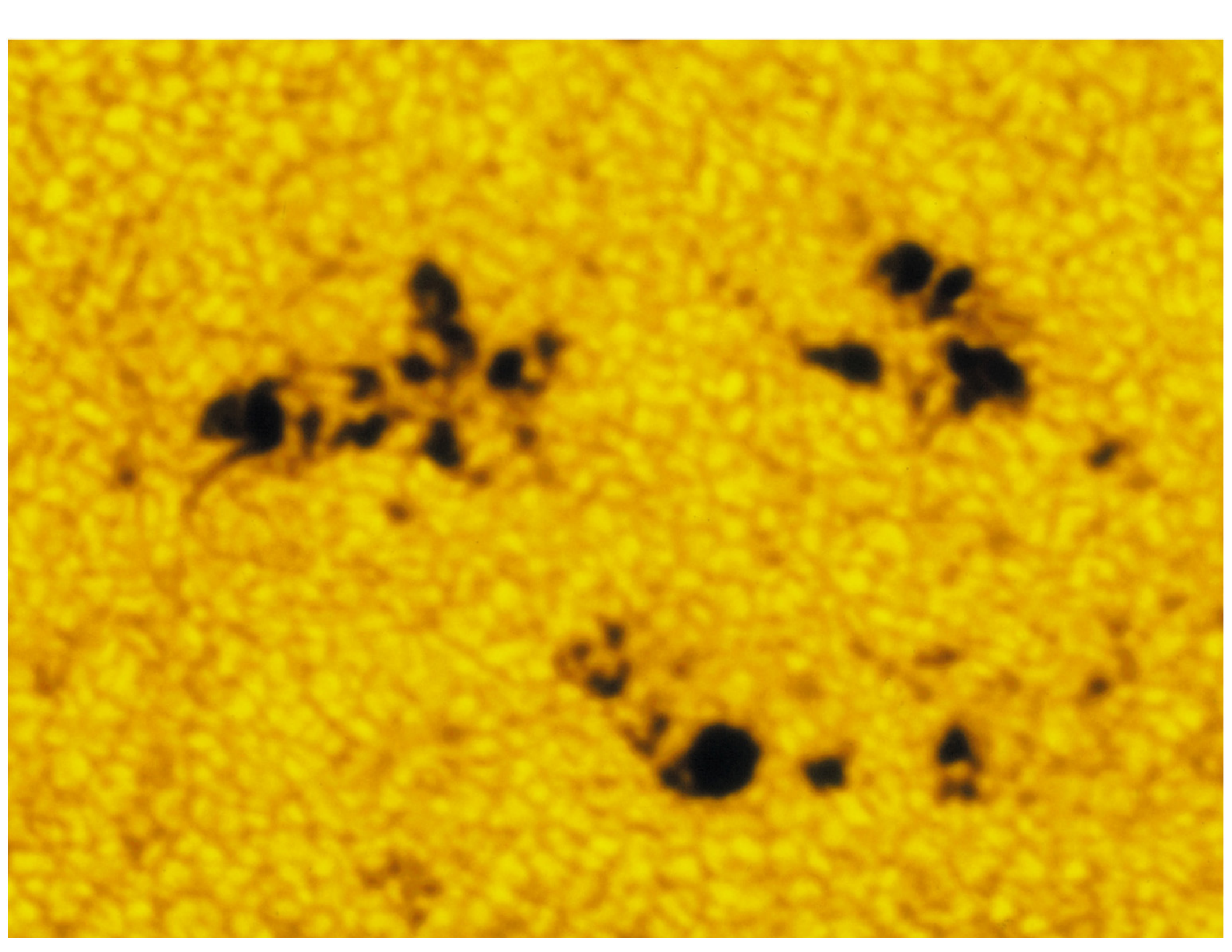
Galaxies

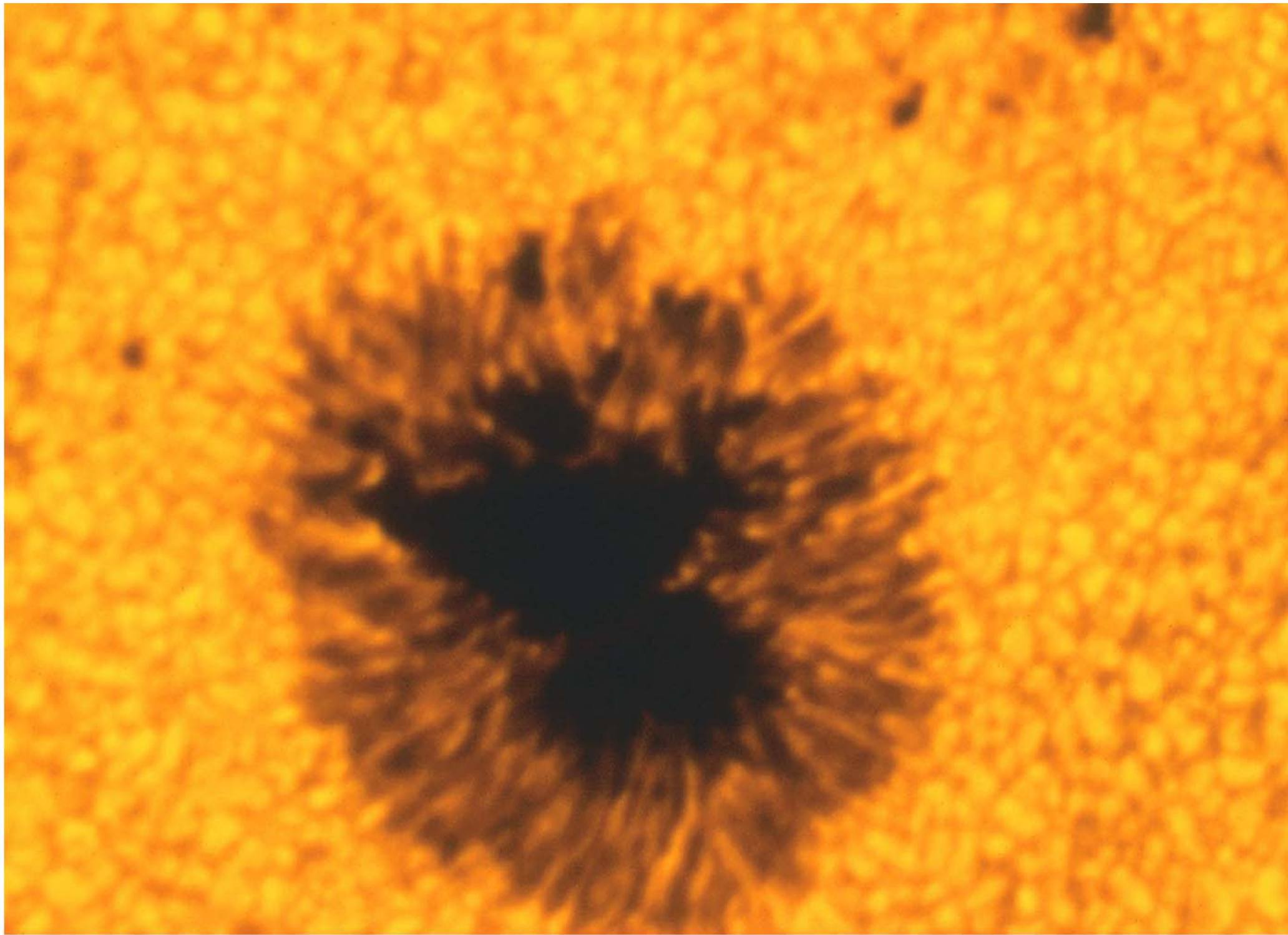
[click for 6/page to print](#)

Midterm Exam

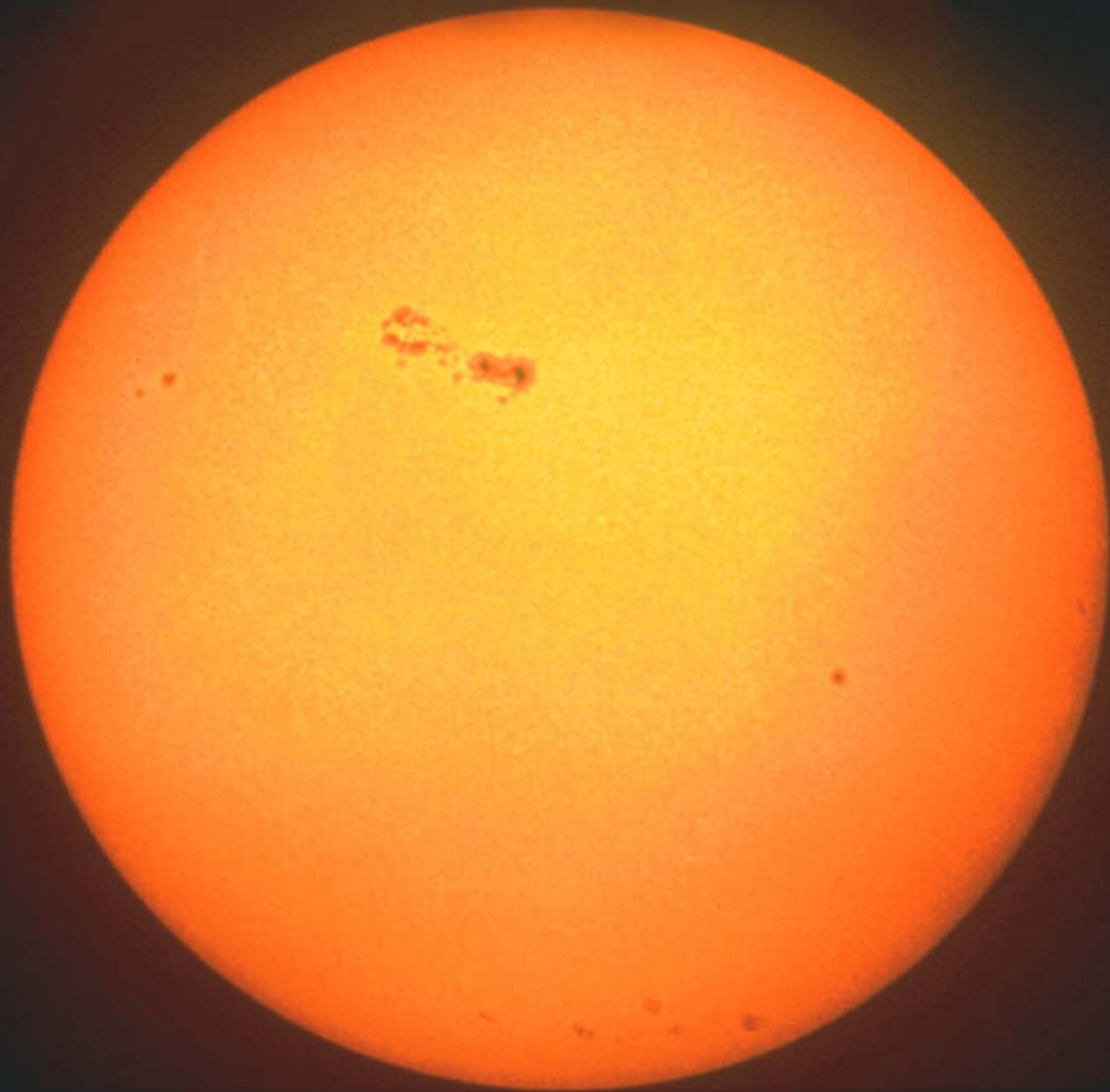
- The in-class activities are posted on webpage and online.wou.edu—study them for the exam.
- A study guide, answers to review questions, and last year's exam are posted on line also
- Bring a scantron and a pencil



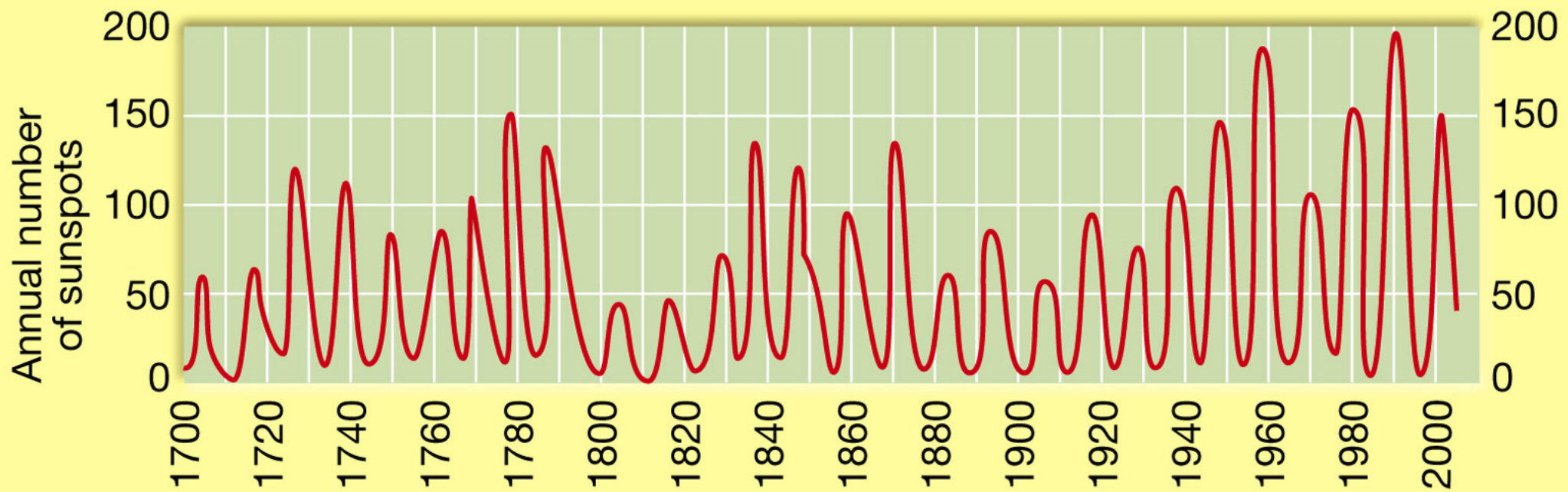




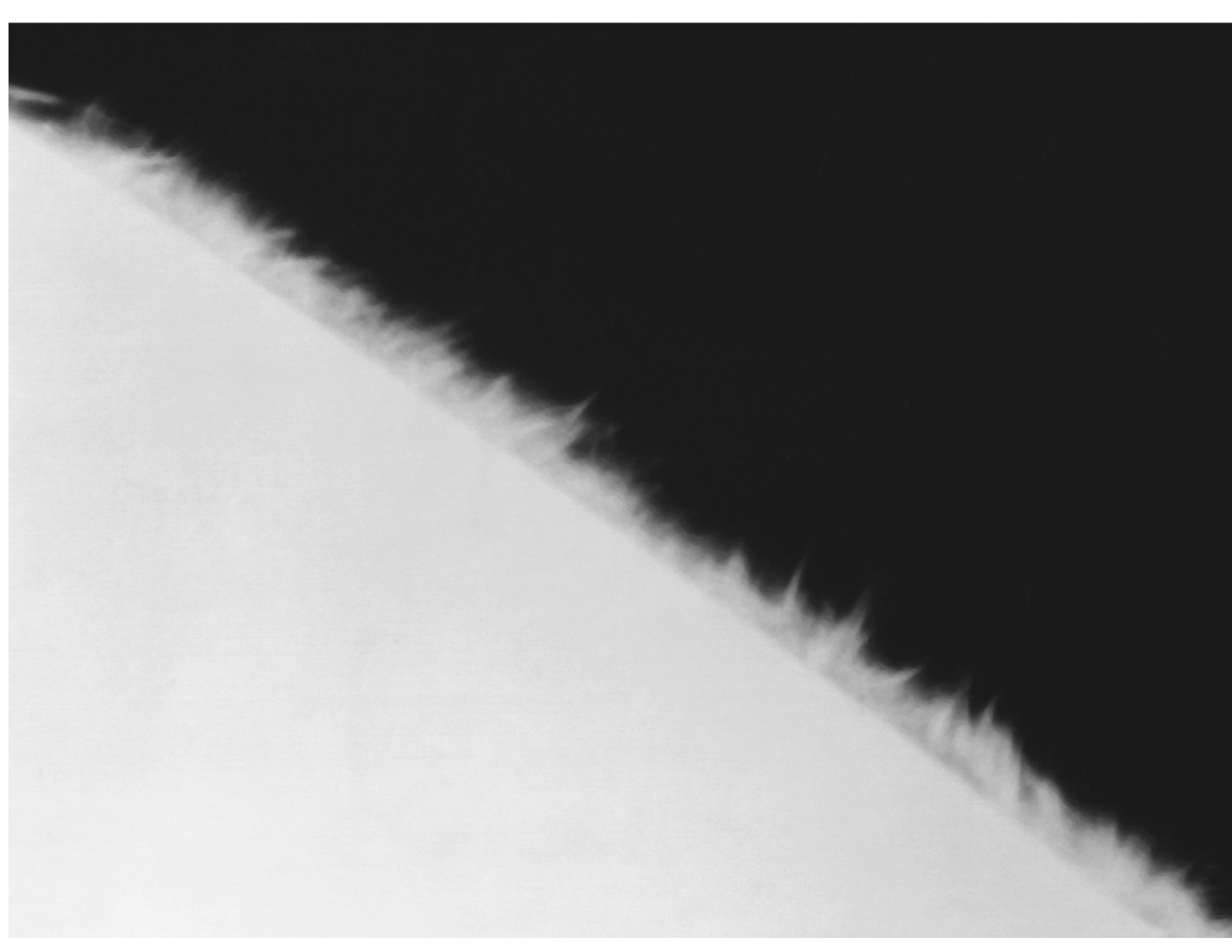
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Sunspot Variation over time



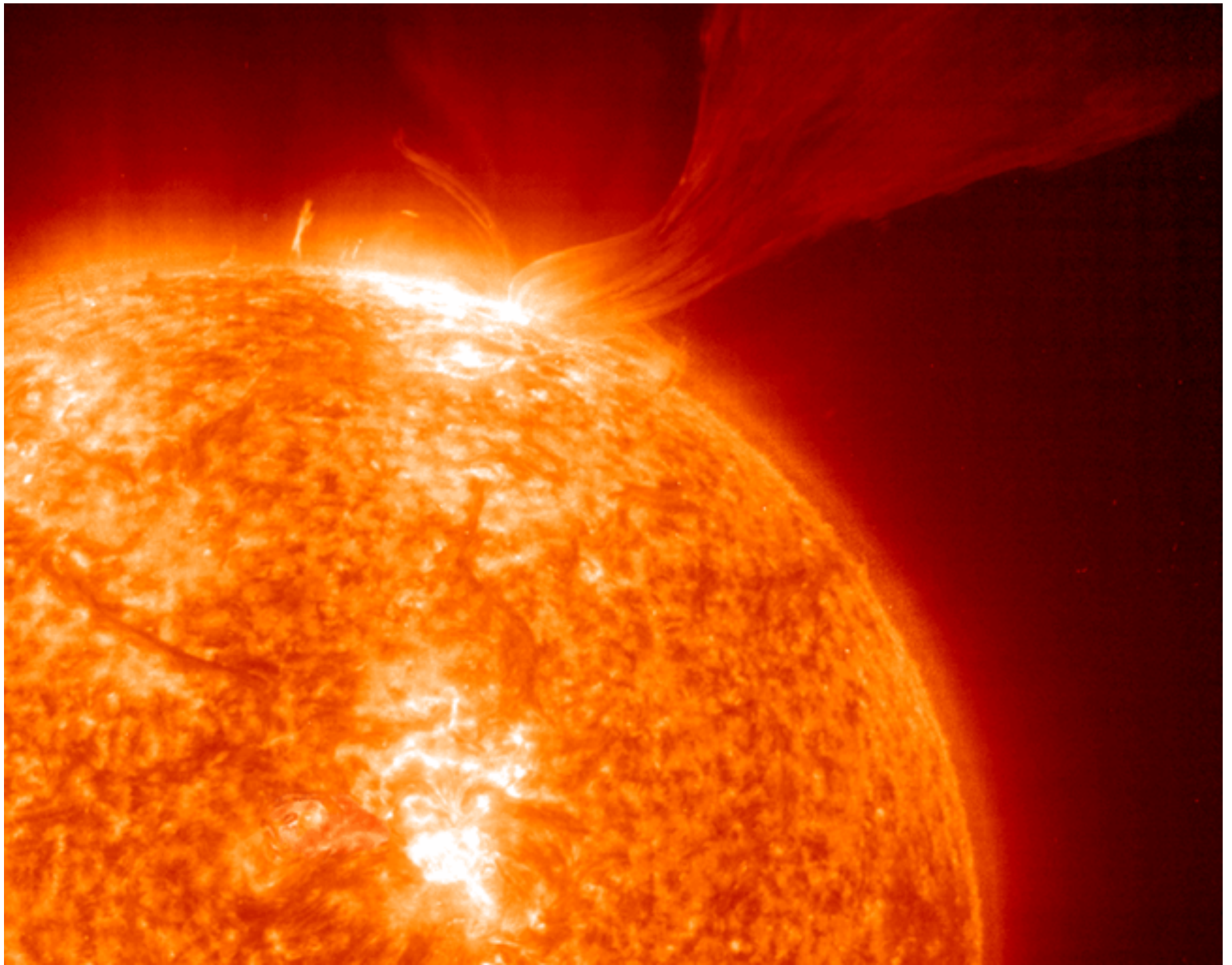
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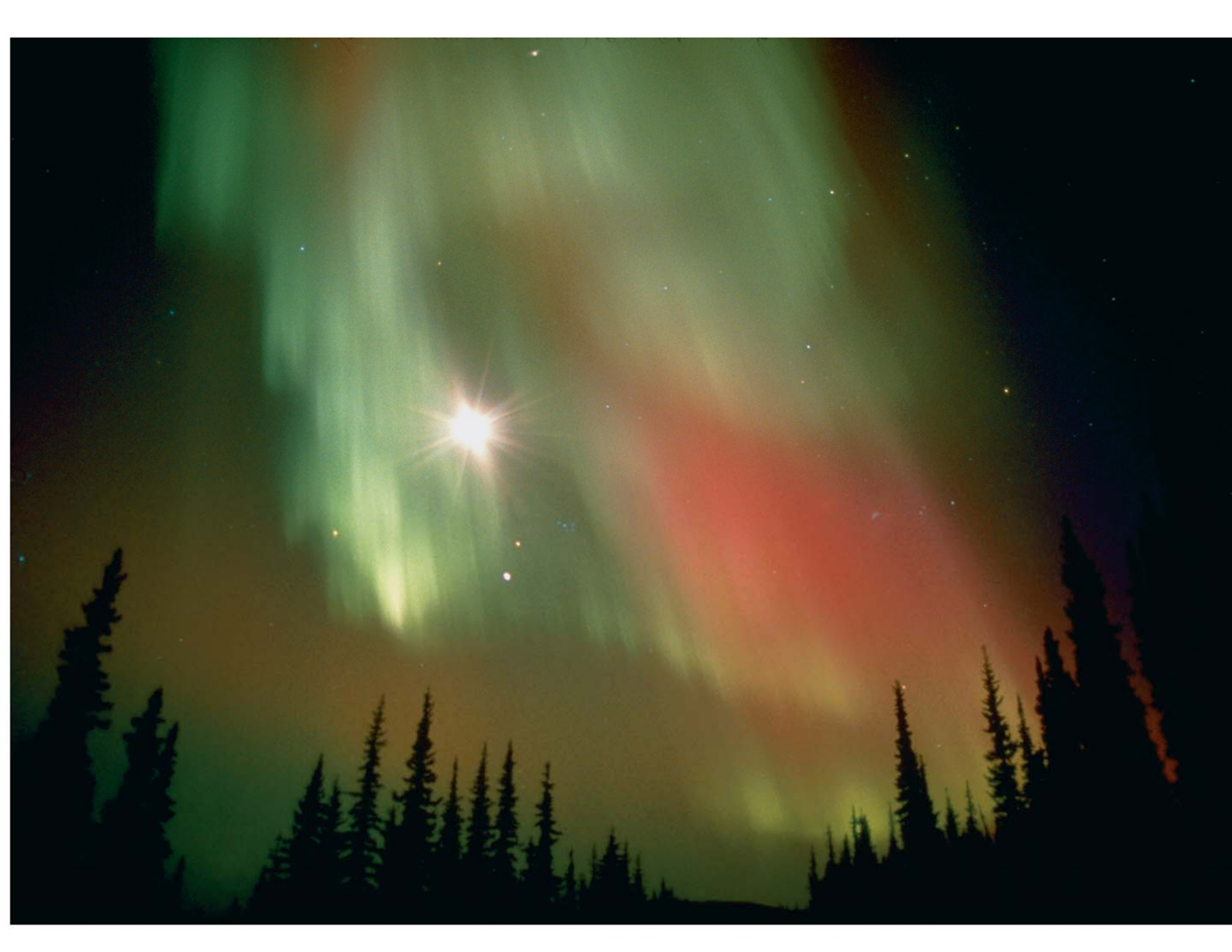
<http://www.astro.uva.nl/demo/sun/inter.htm>



http://antwrp.gsfc.nasa.gov/apod/image/0109/sunplume_soho_big.gif

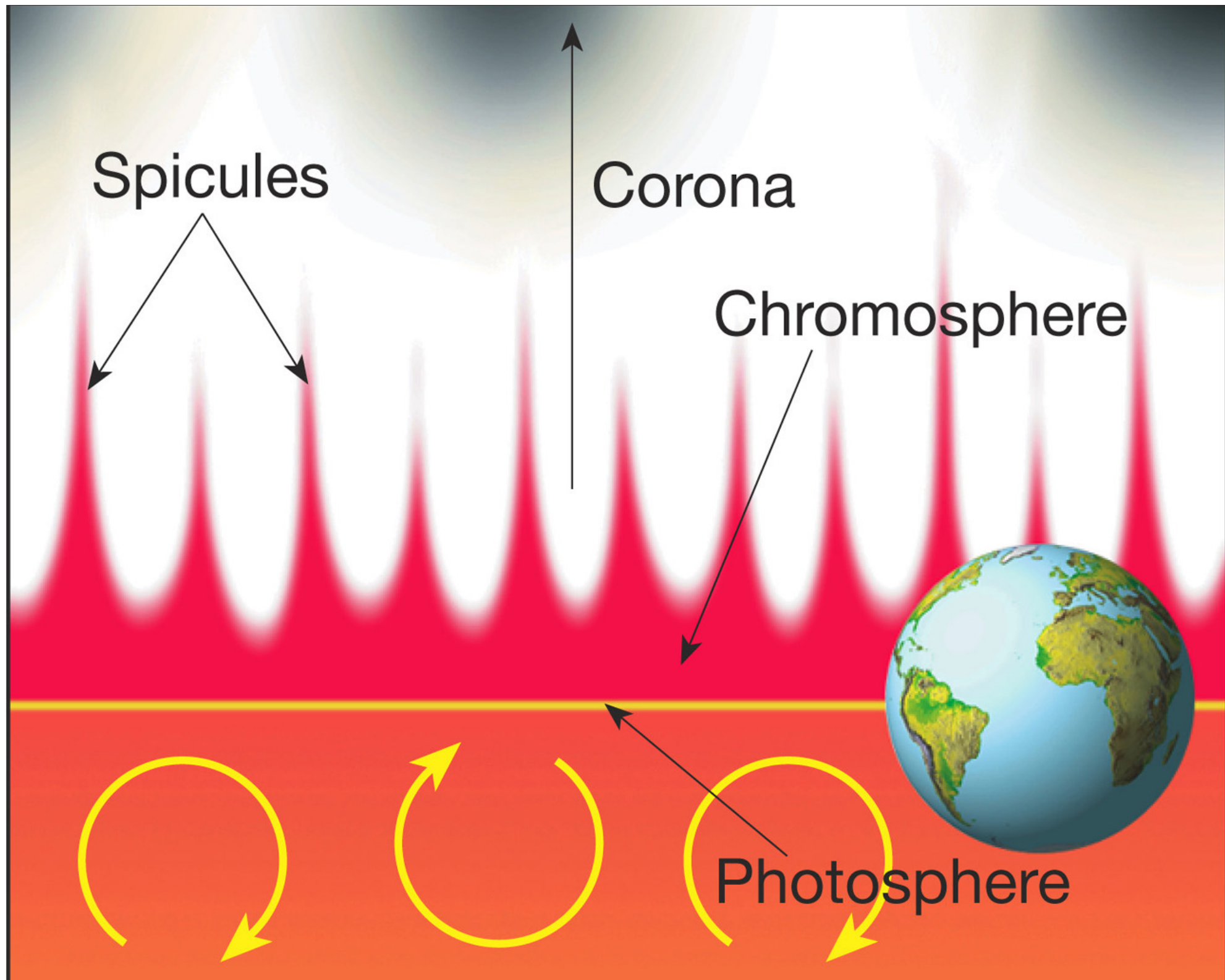
Video clip <http://antwrp.gsfc.nasa.gov/apod/ap030223.html>

Another video clip http://spacescience.com/headlines/images/prominence/prominence_10jan00.mov



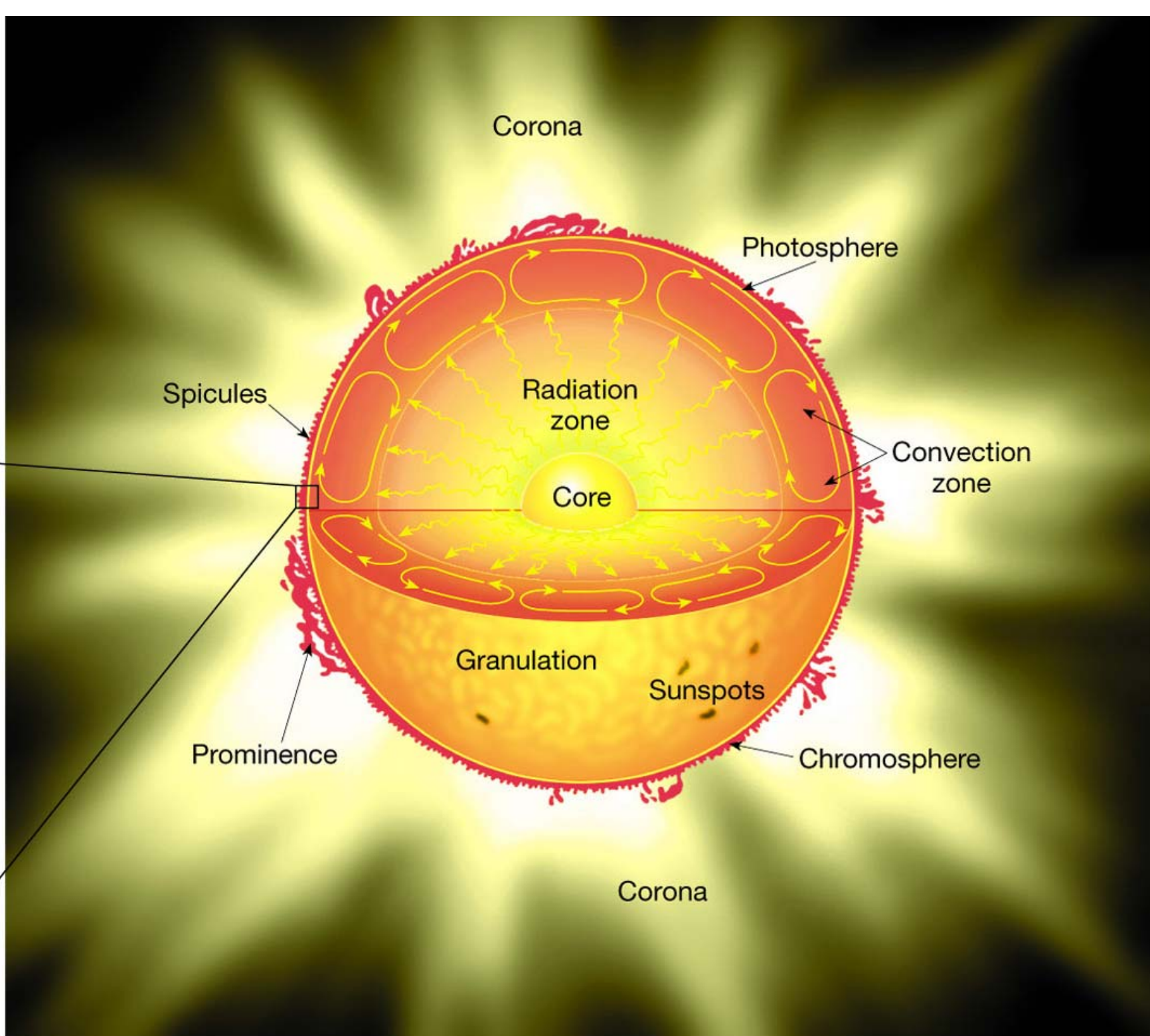


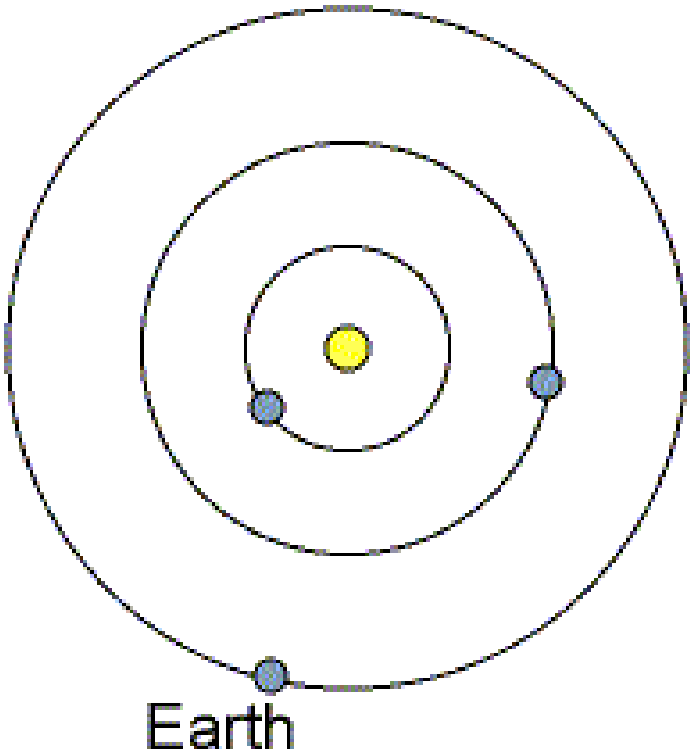
<http://www.astro.uva.nl/demo/sun/aarde.htm>



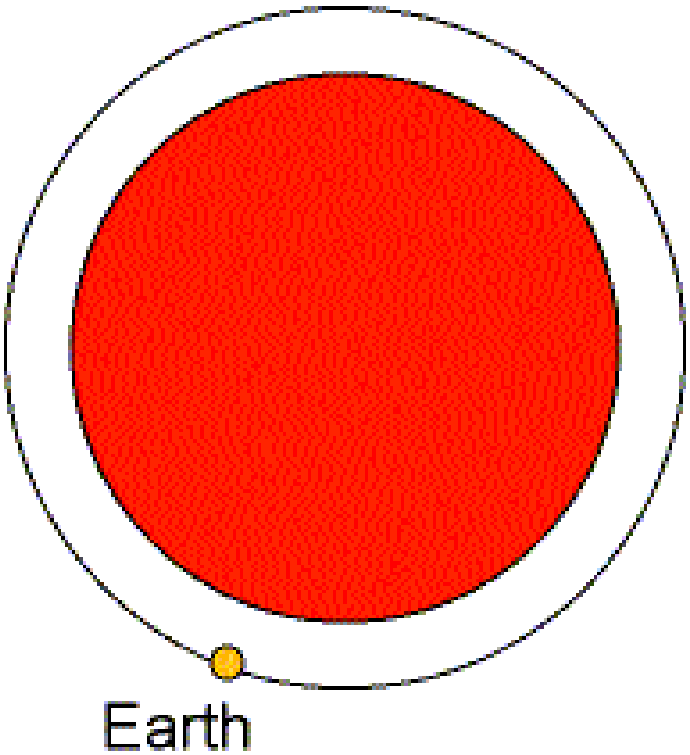
Solar Interior

- Nuclear Fusion of 4 Hydrogen to 1 Helium
- Difference in atomic mass is released as energy
- Released as photons—light particles
- Convection brings photons to photosphere
- Sun will last about another 5 billion years



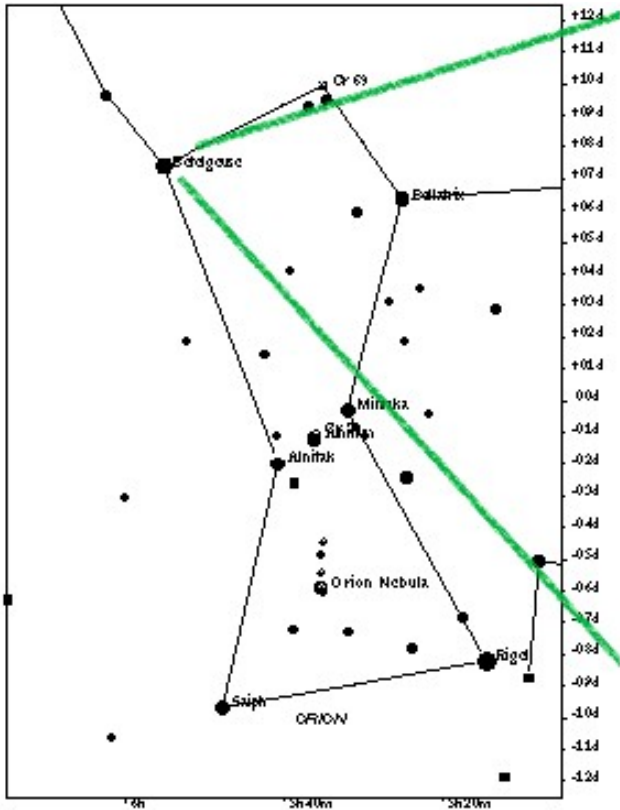


Now: hot core + warm surface; small size.

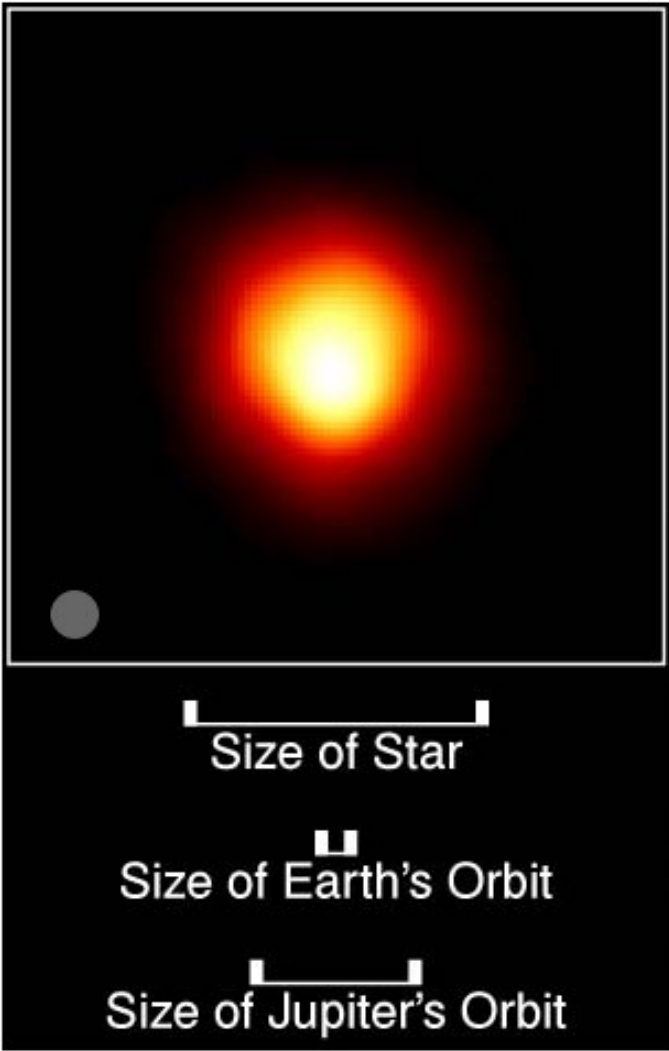


Future: very hot core + cool surface. Large size but less mass; very bright.

Red Giant Betelgeuse

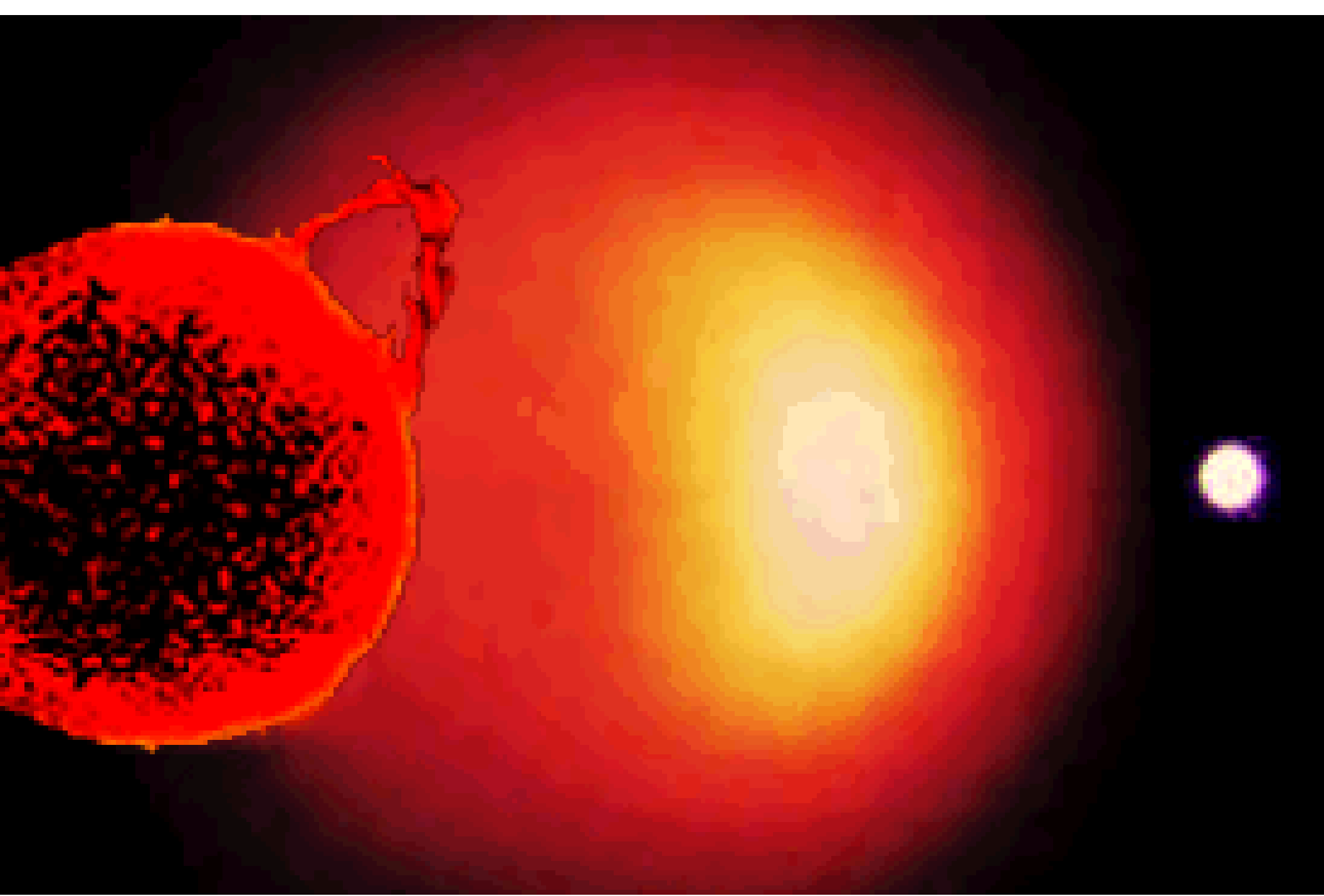


HST view of Betelgeuse in the ultraviolet. Even though Betelgeuse is very large, its distance is too great to resolve details smaller than about 1/4th of its diameter (small gray circle).





<http://www.astro.uva.nl/demo/sun/leven.htm>

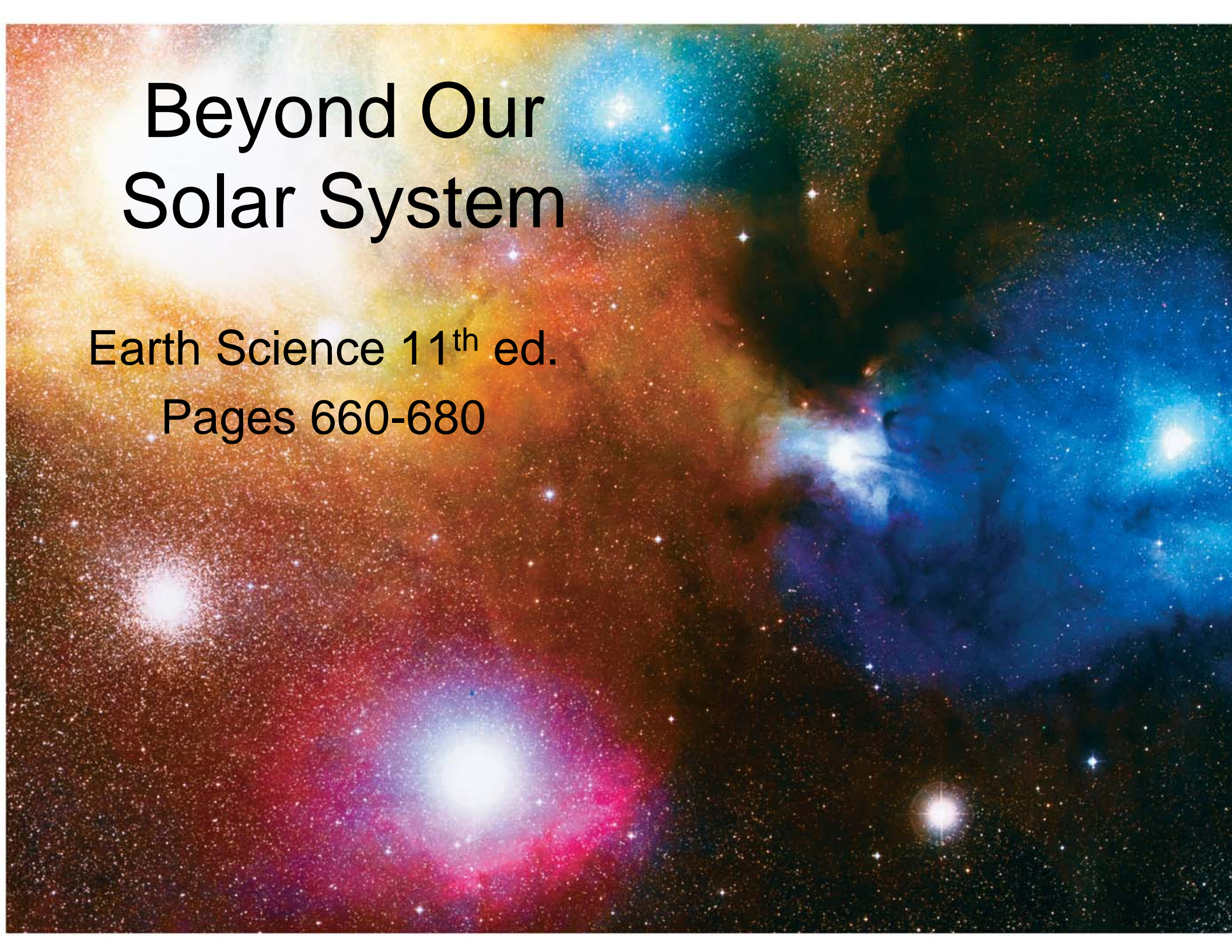


http://imagine.gsfc.nasa.gov/docs/science/known_l2/dwarfs.html

Beyond Our Solar System

Earth Science 11th ed.

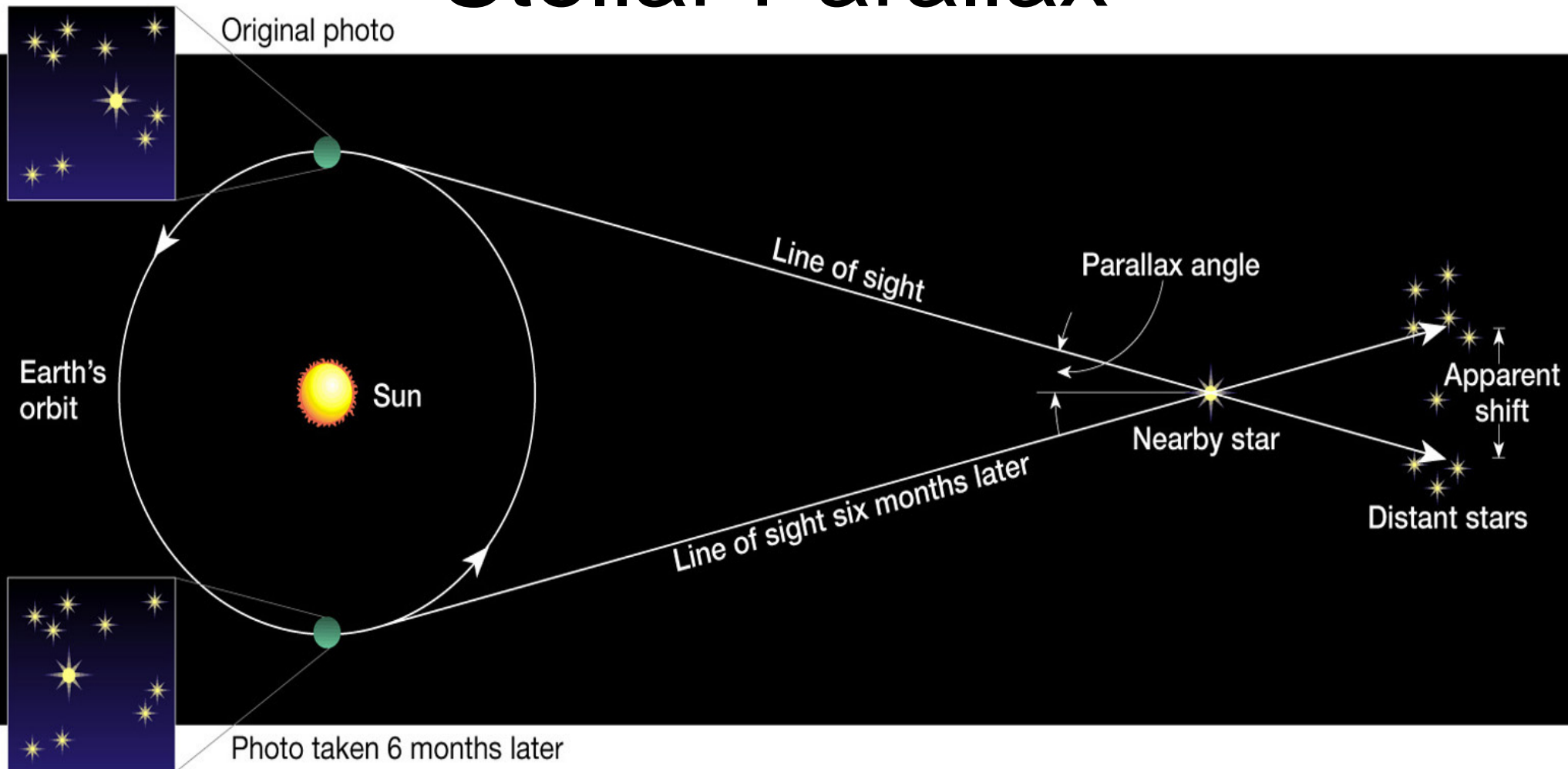
Pages 660-680



Lagoon Nebula



Stellar Parallax



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Stellar Parallax

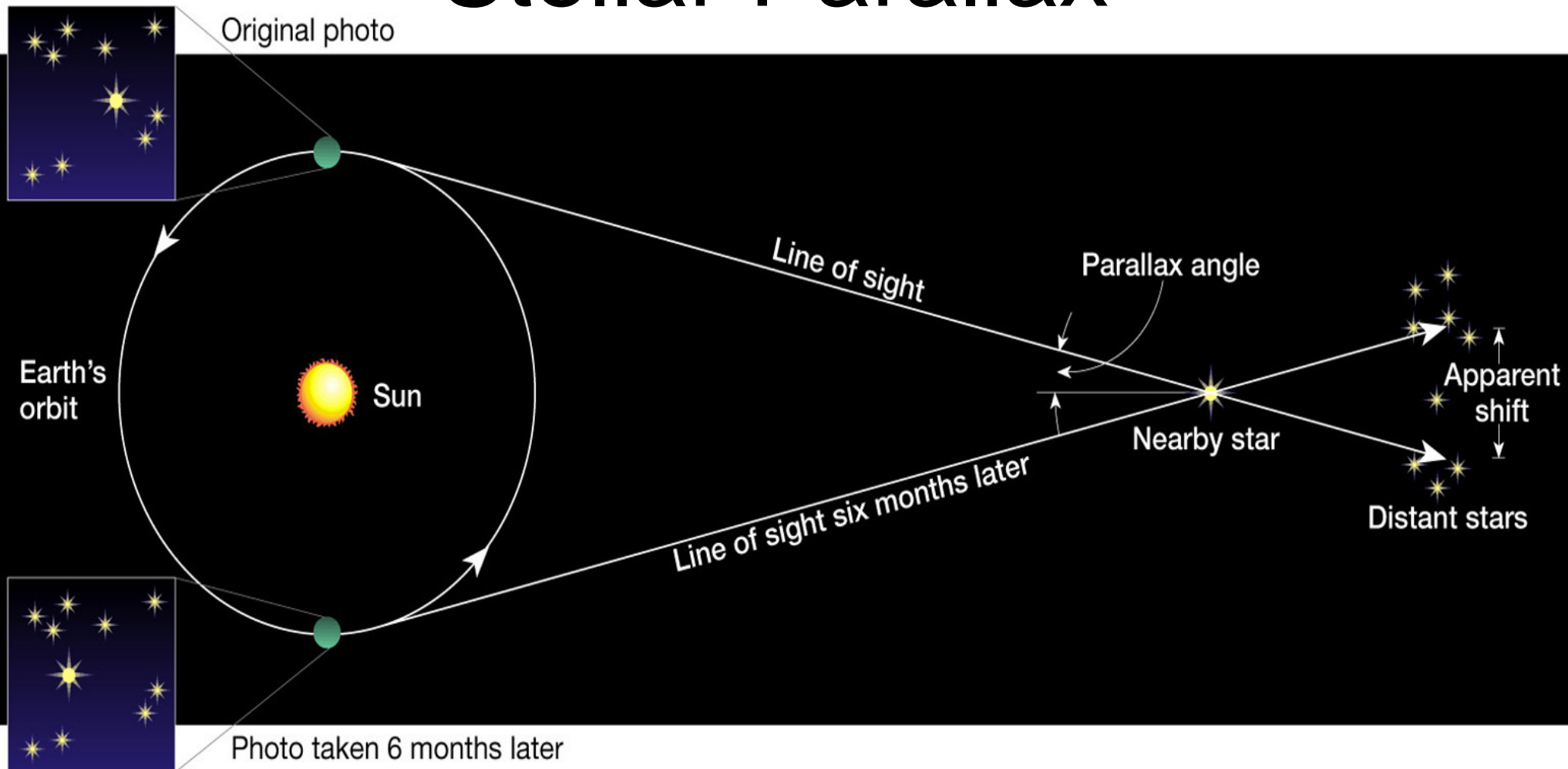
Original Photo



Six months later



Stellar Parallax

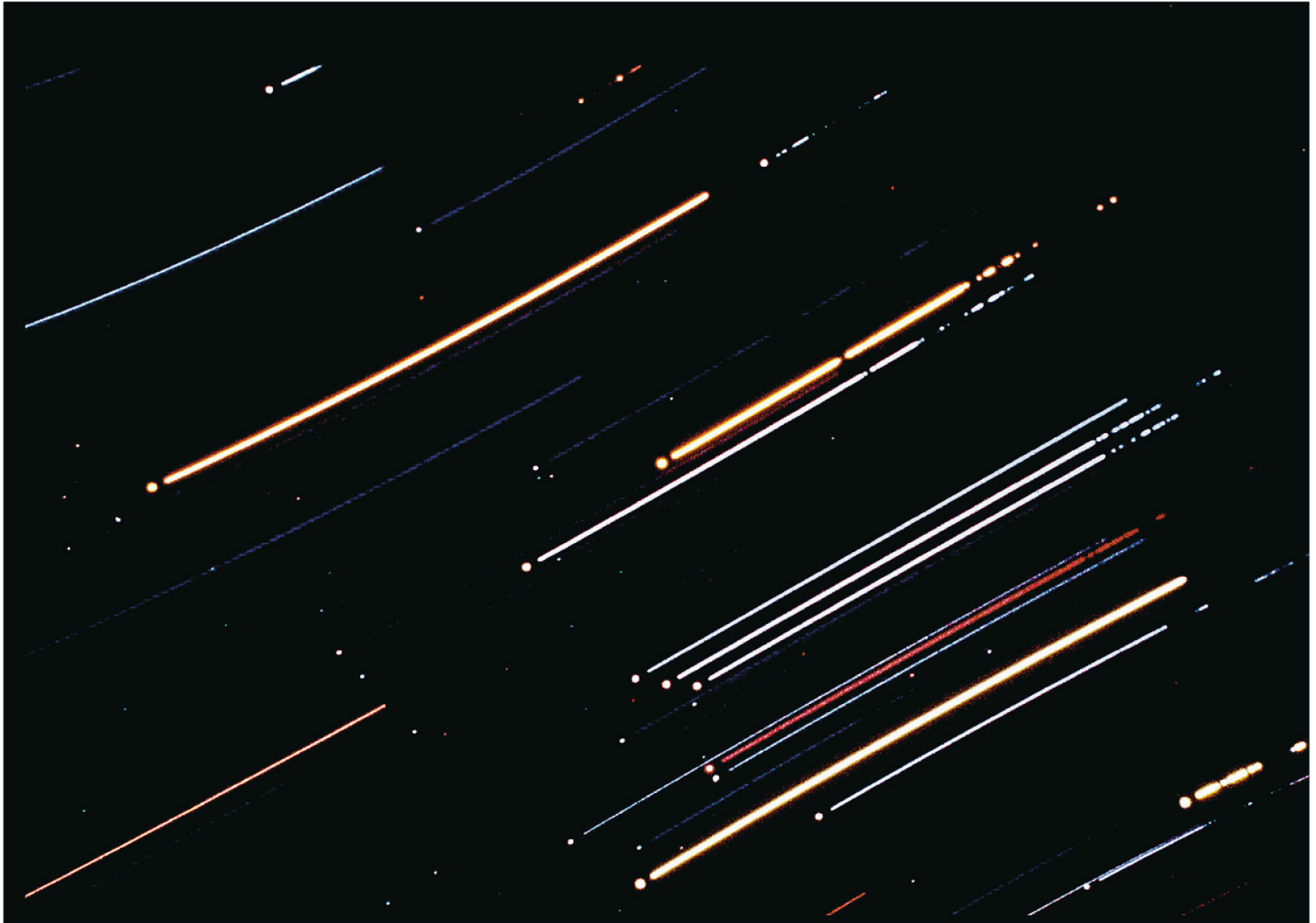


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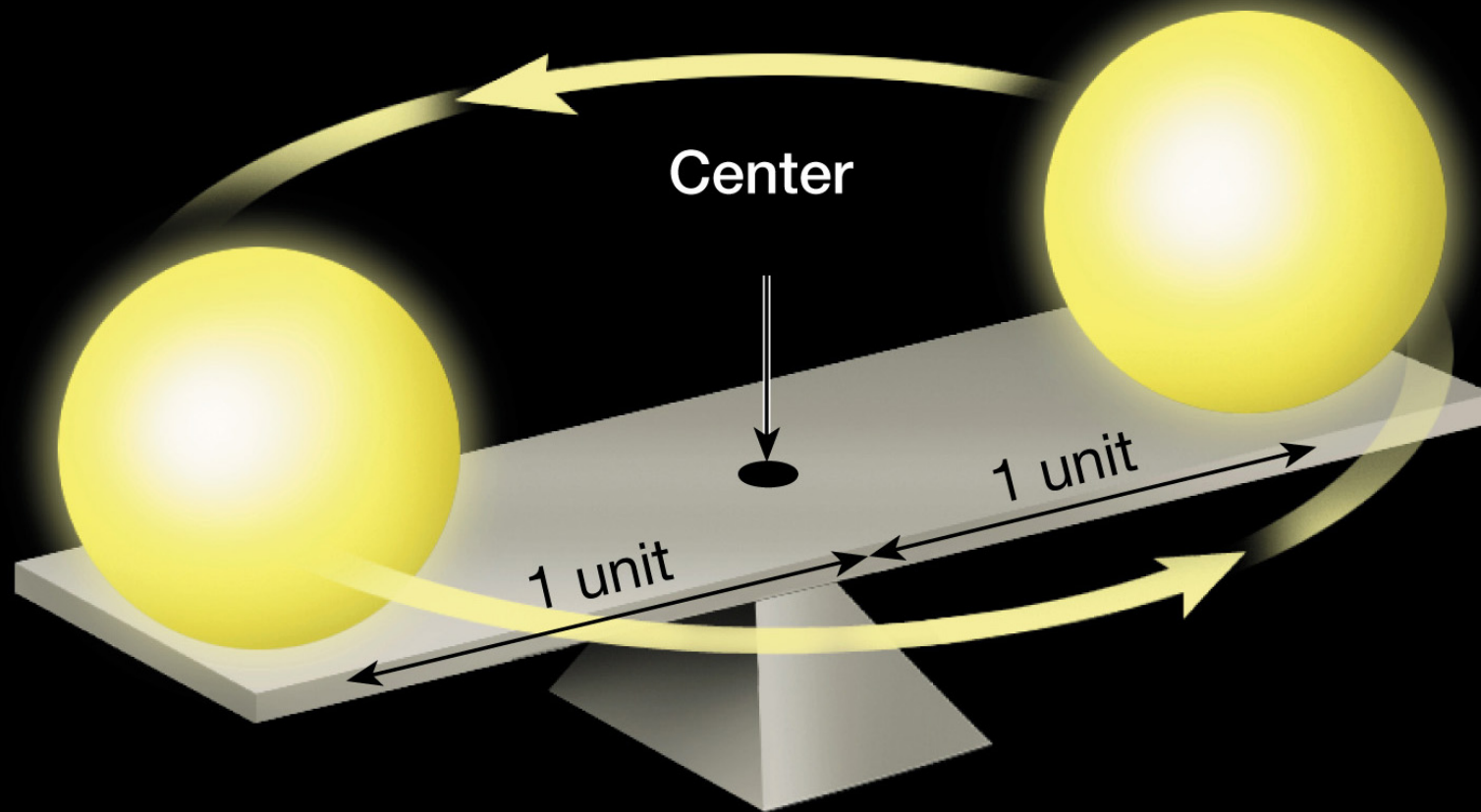
Parallax angle

- 1 second of arc = $1/3600$ of a degree
- Closest star is 4.3 light years away
- Light year is not a time period, it is a **distance**
 - How far light travels in a year
 - 9.5 trillion kilometers
 - 5.8 trillion miles

Star Colors (time lapse photo)

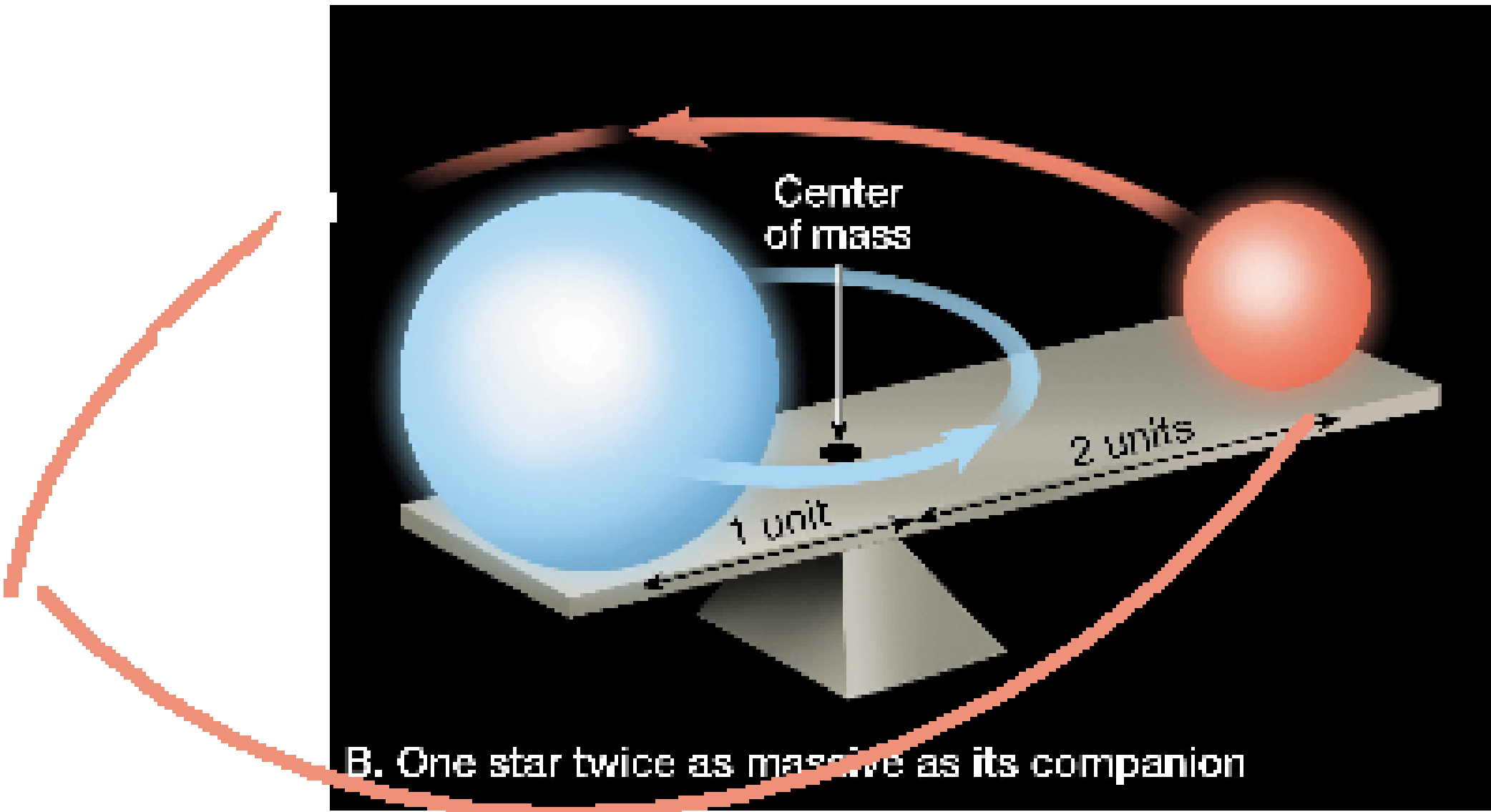


Equal Mass Stars

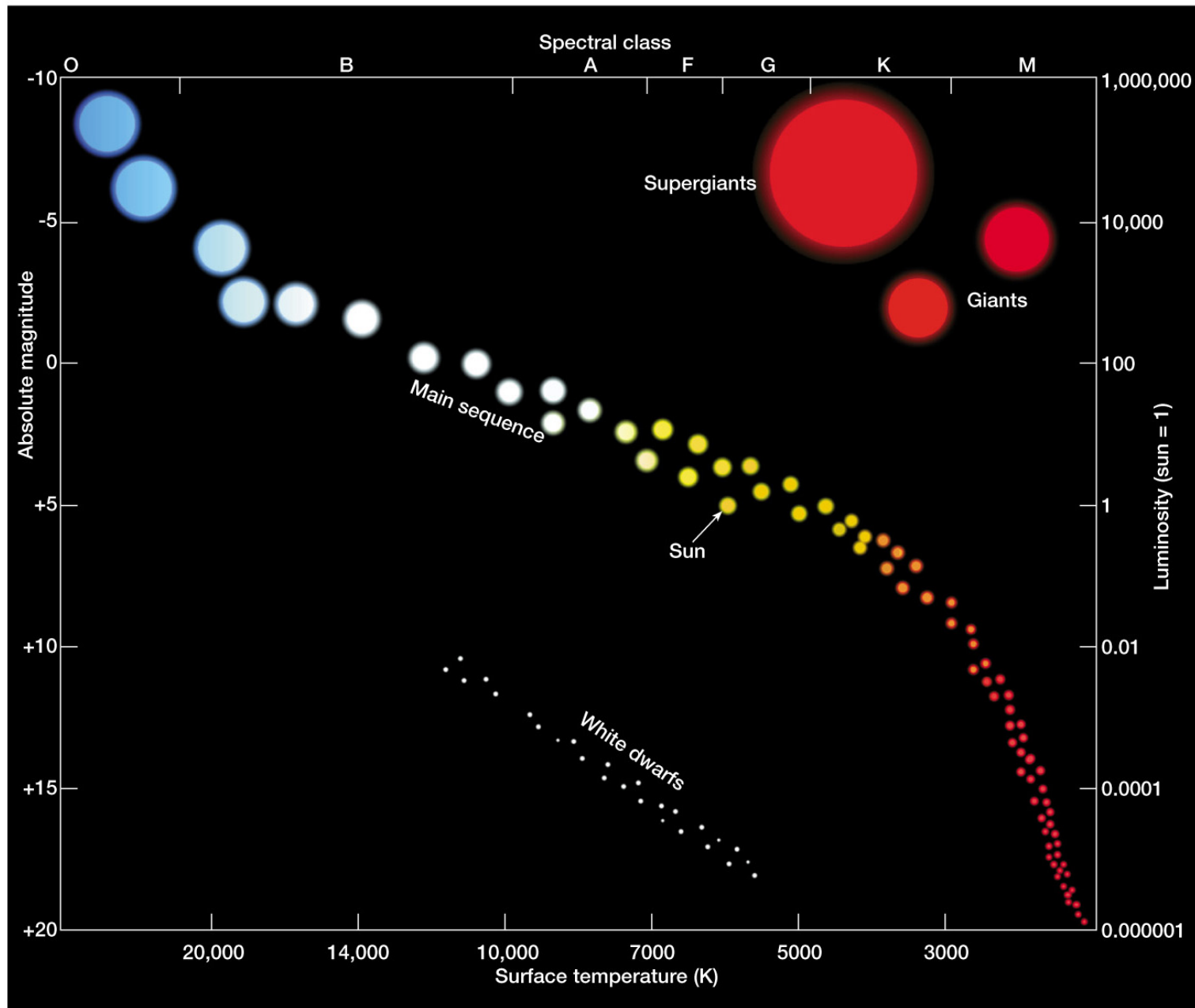


A. Two stars of equal mass

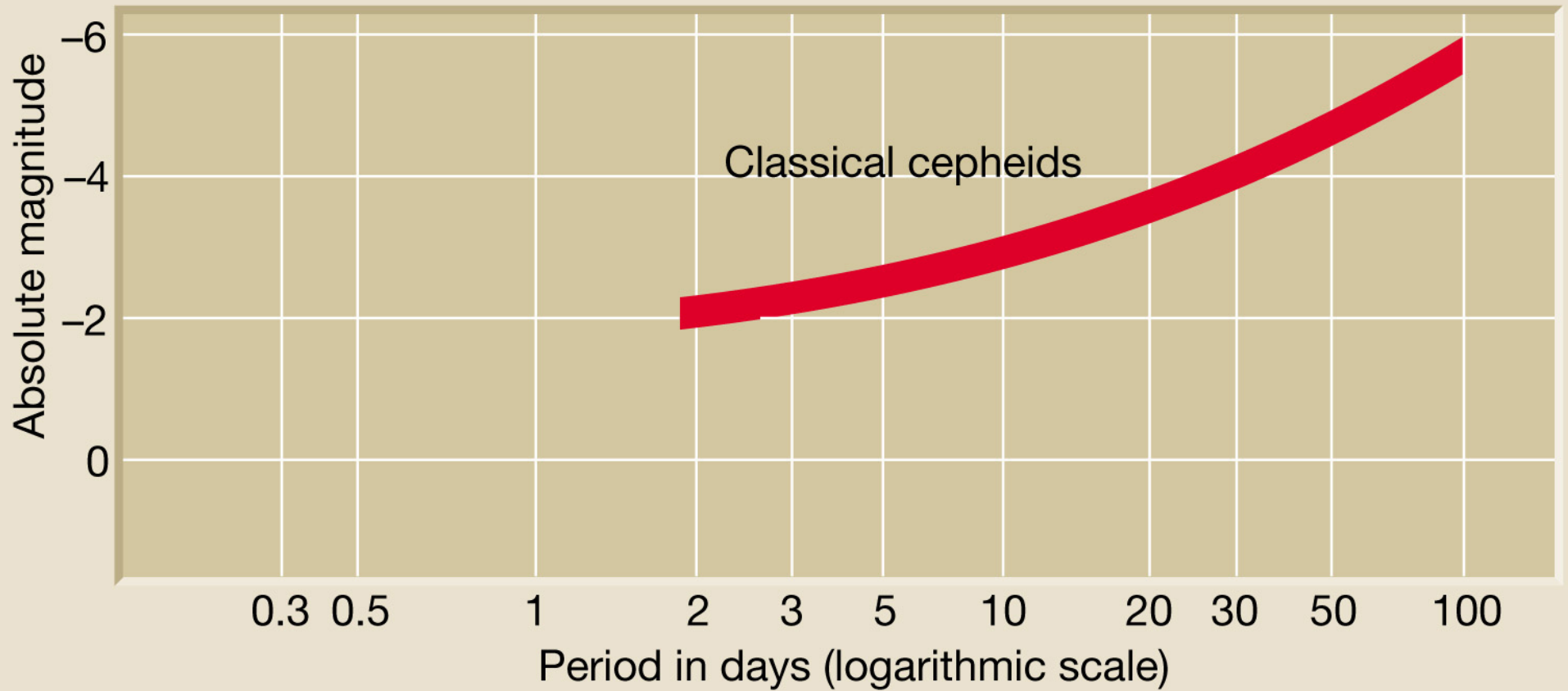
One is twice mass of other



Star temperature vs. magnitude



Pulsating magnitude



Nova Herculis

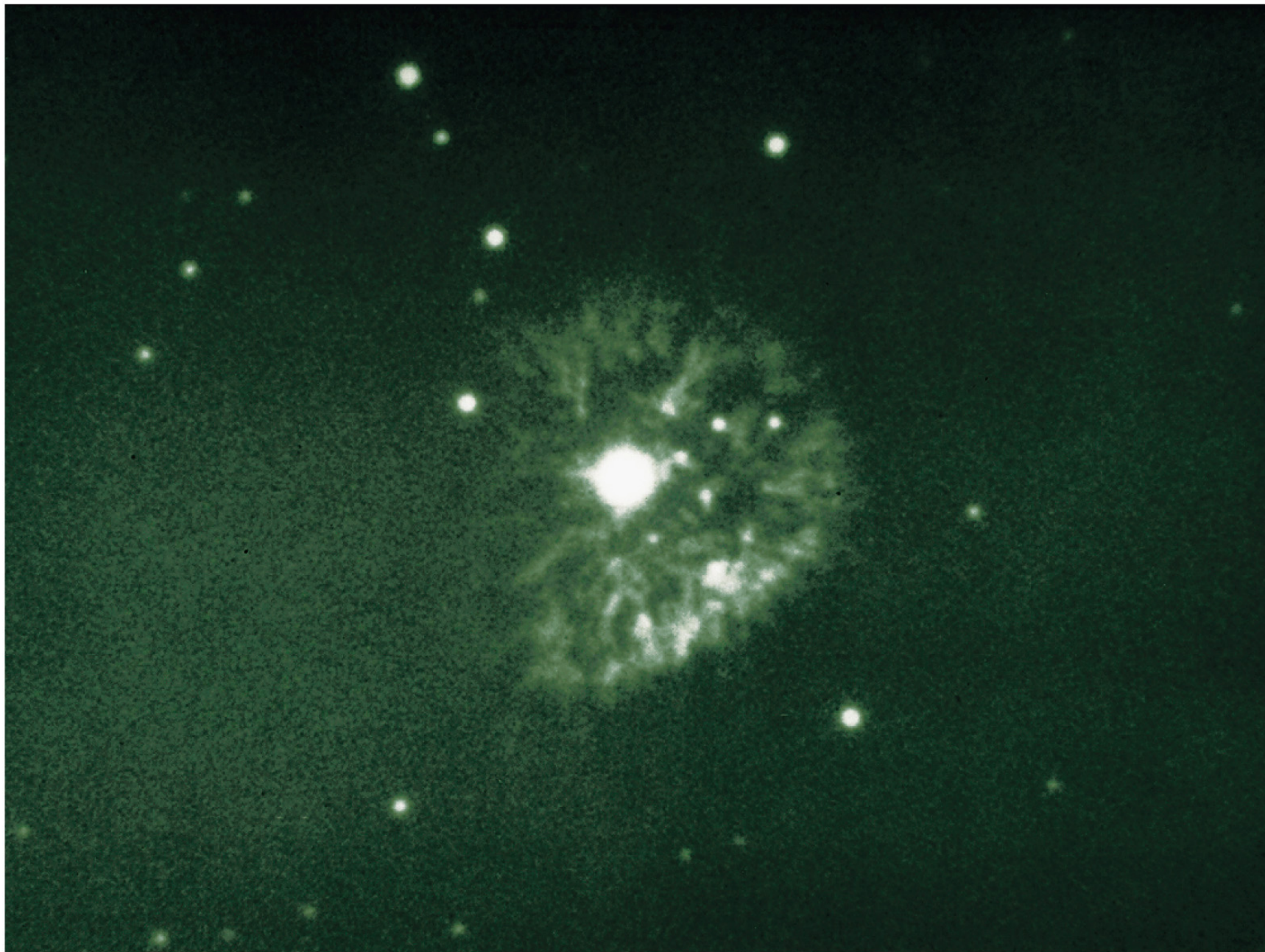


March 10, 1935



May 6, 1935

Nova Persei



Orion Nebula



Pleiades
star
cluster
has
reflection
nebula



Horsehead Nebula

Dark nebula in Orion

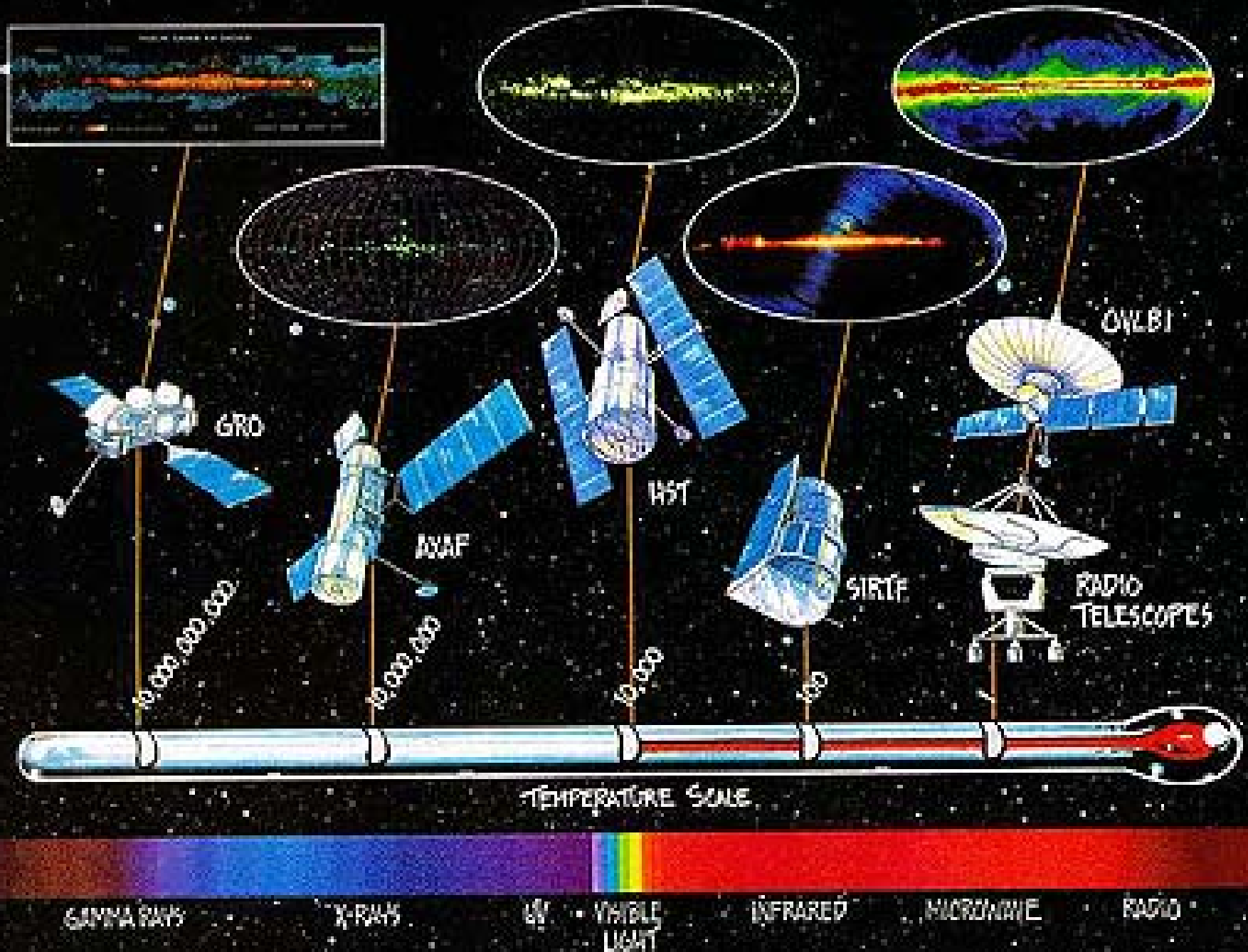


Closeup

Protostars at
base of head

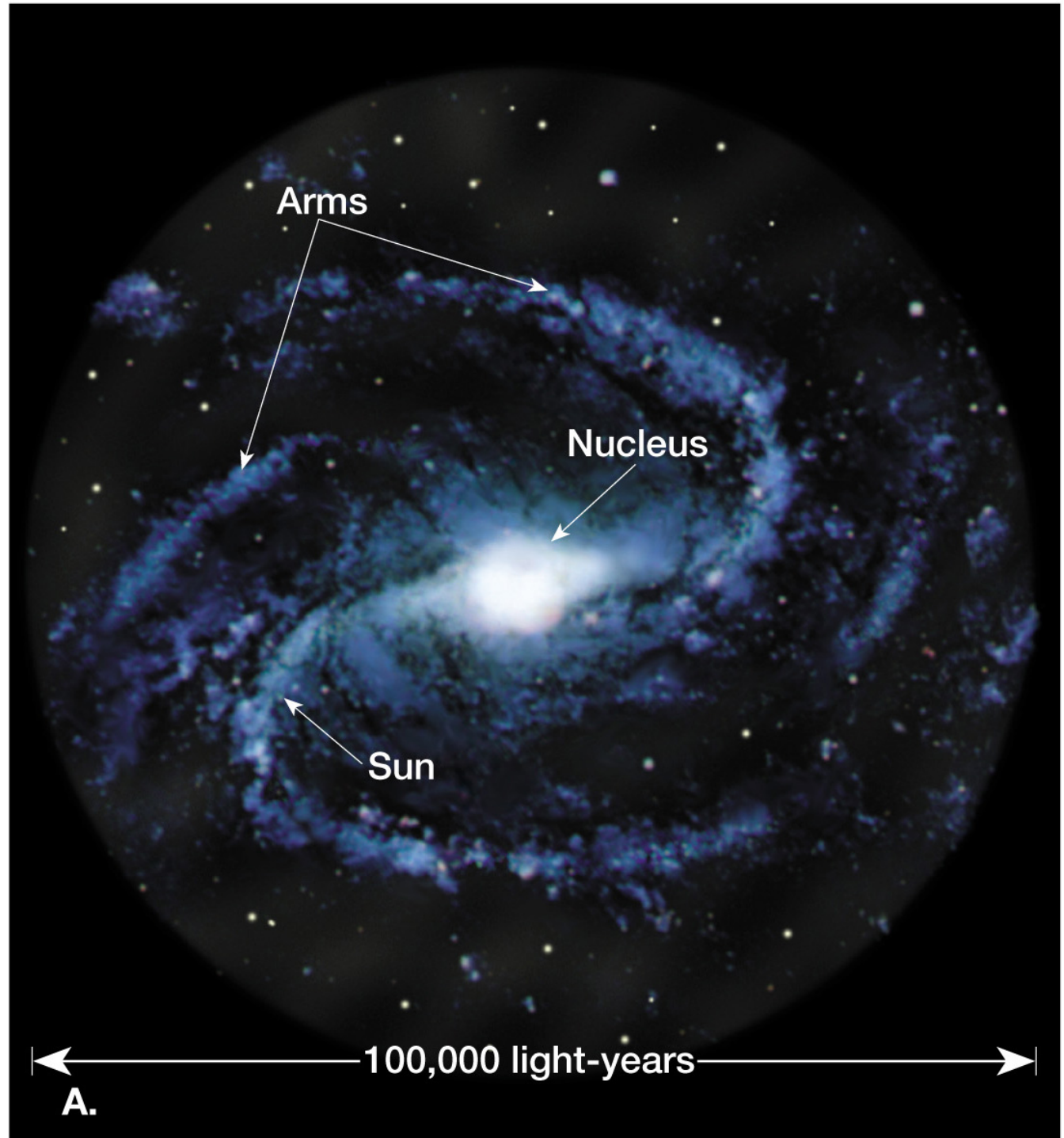


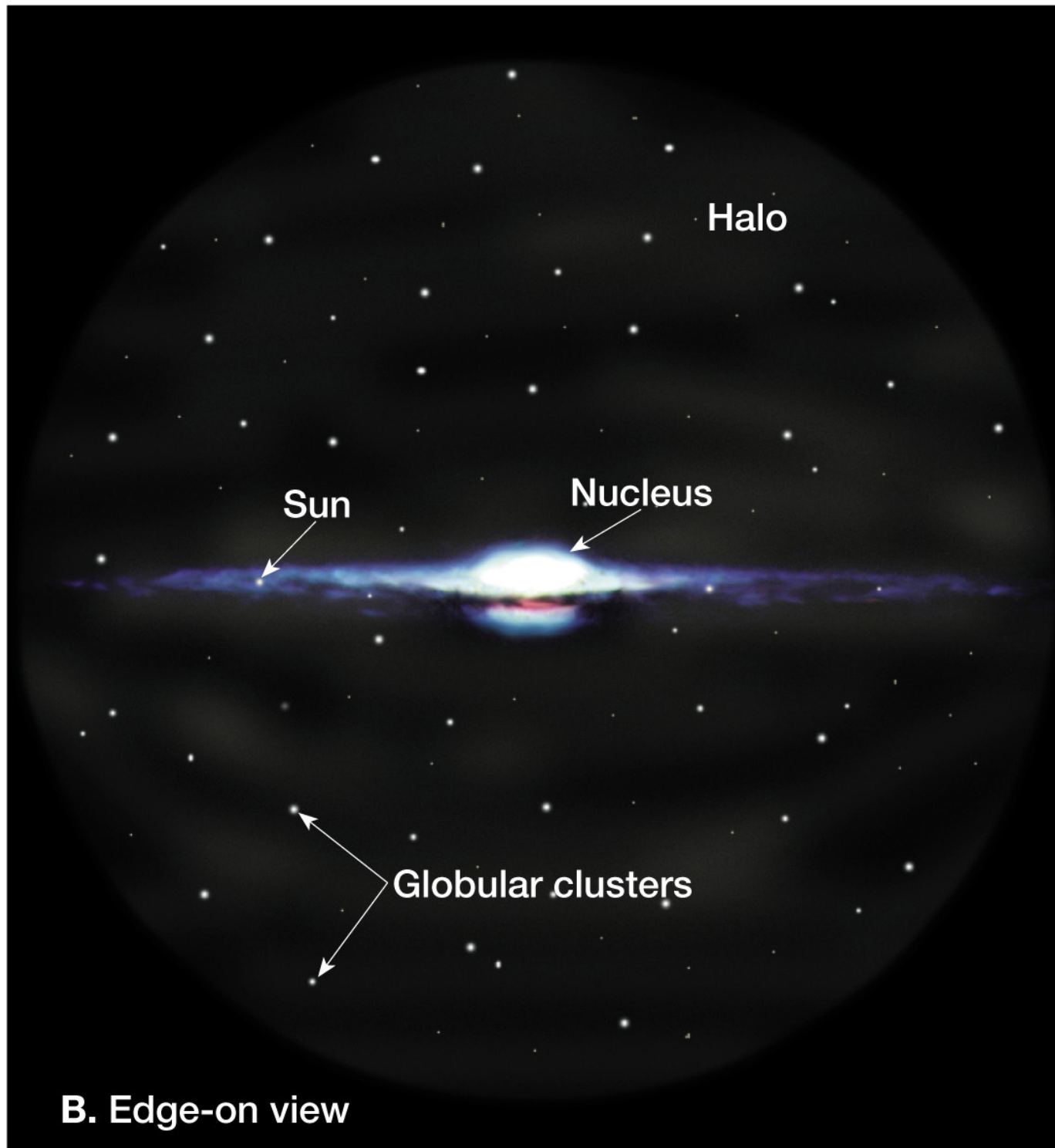
PERSPECTIVES ON THE MILKY WAY



Milky Way

- Spiral
- 200 billion stars
- Black hole in center
- Older stars in center, younger at edges





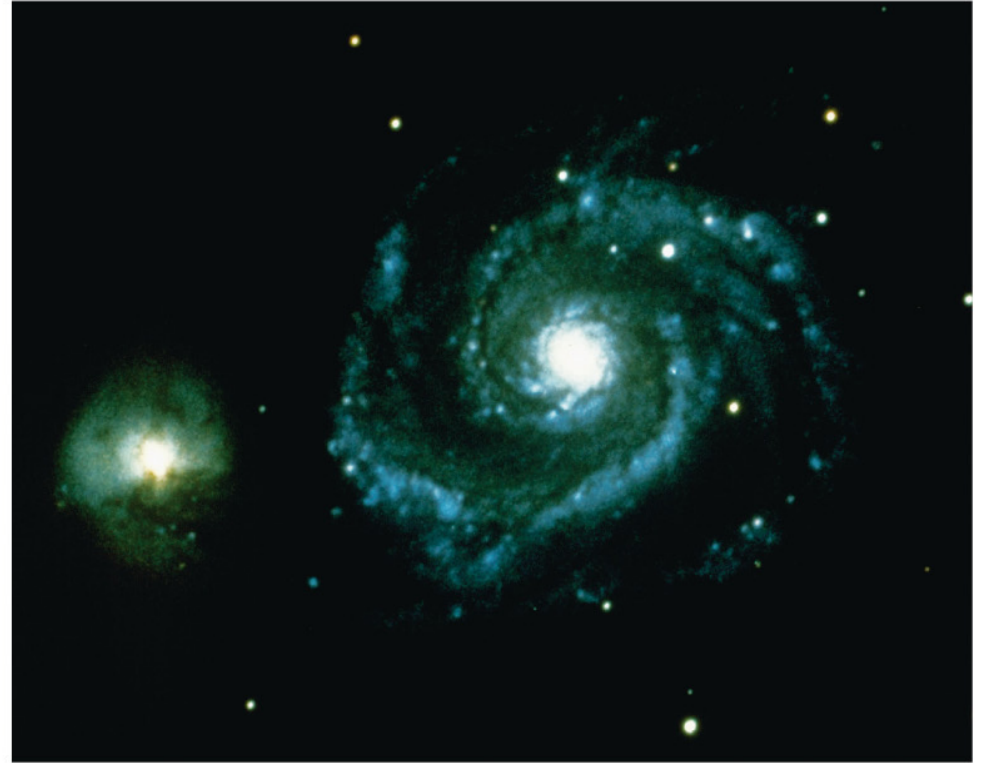
Great Galaxy in Andromeda



Typical spiral galaxies



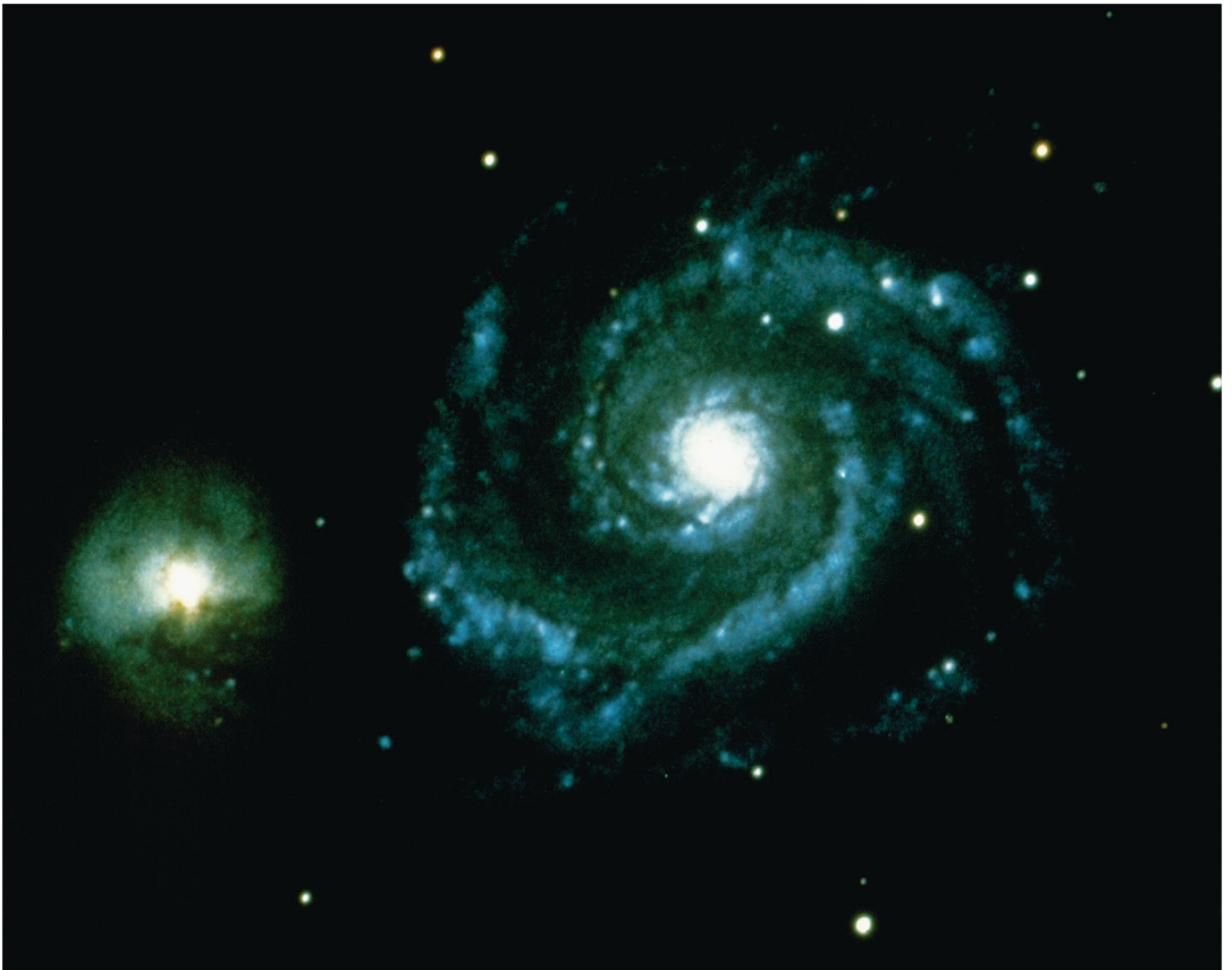
A.



B.



A.



B.

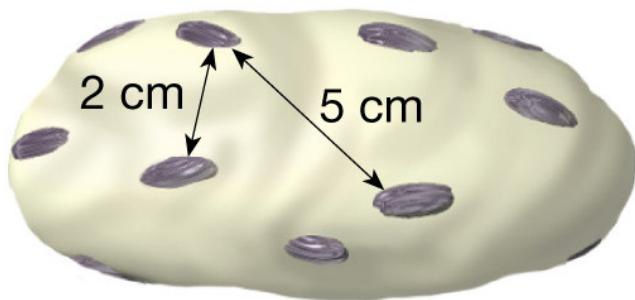
Barred spiral galaxy



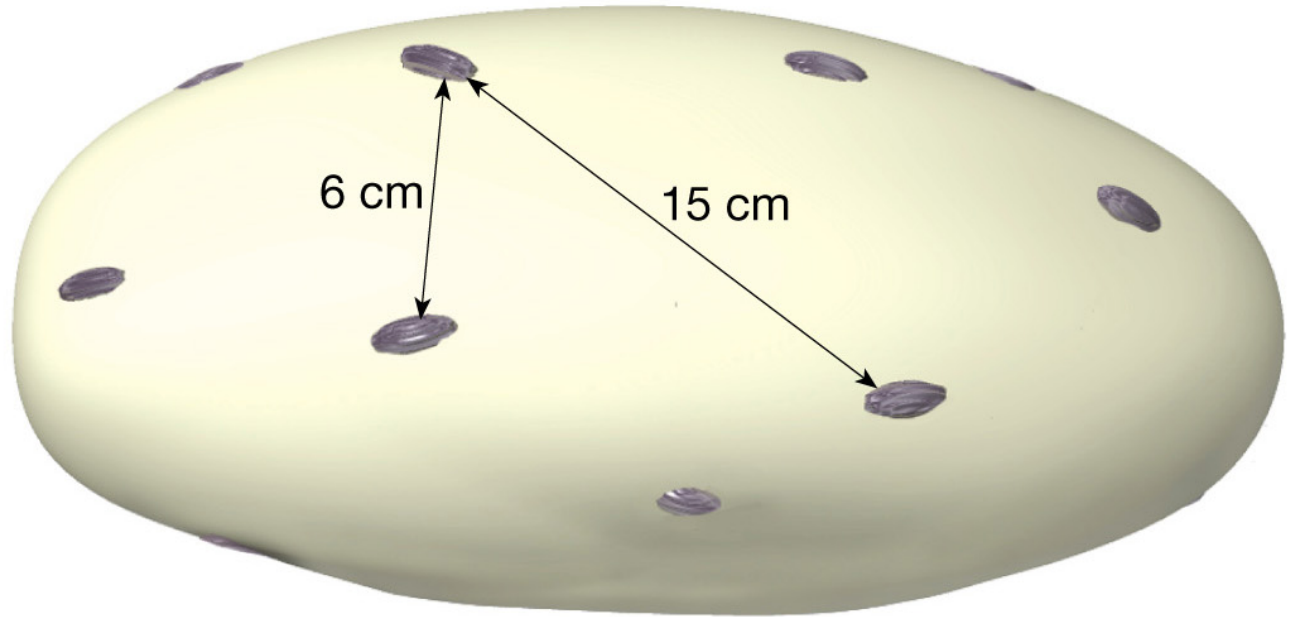
Cluster of galaxies



Raisin bread analogy of the expanding universe



A. Raisin bread dough before it rises.



B. Raisin bread dough a few hours later.

