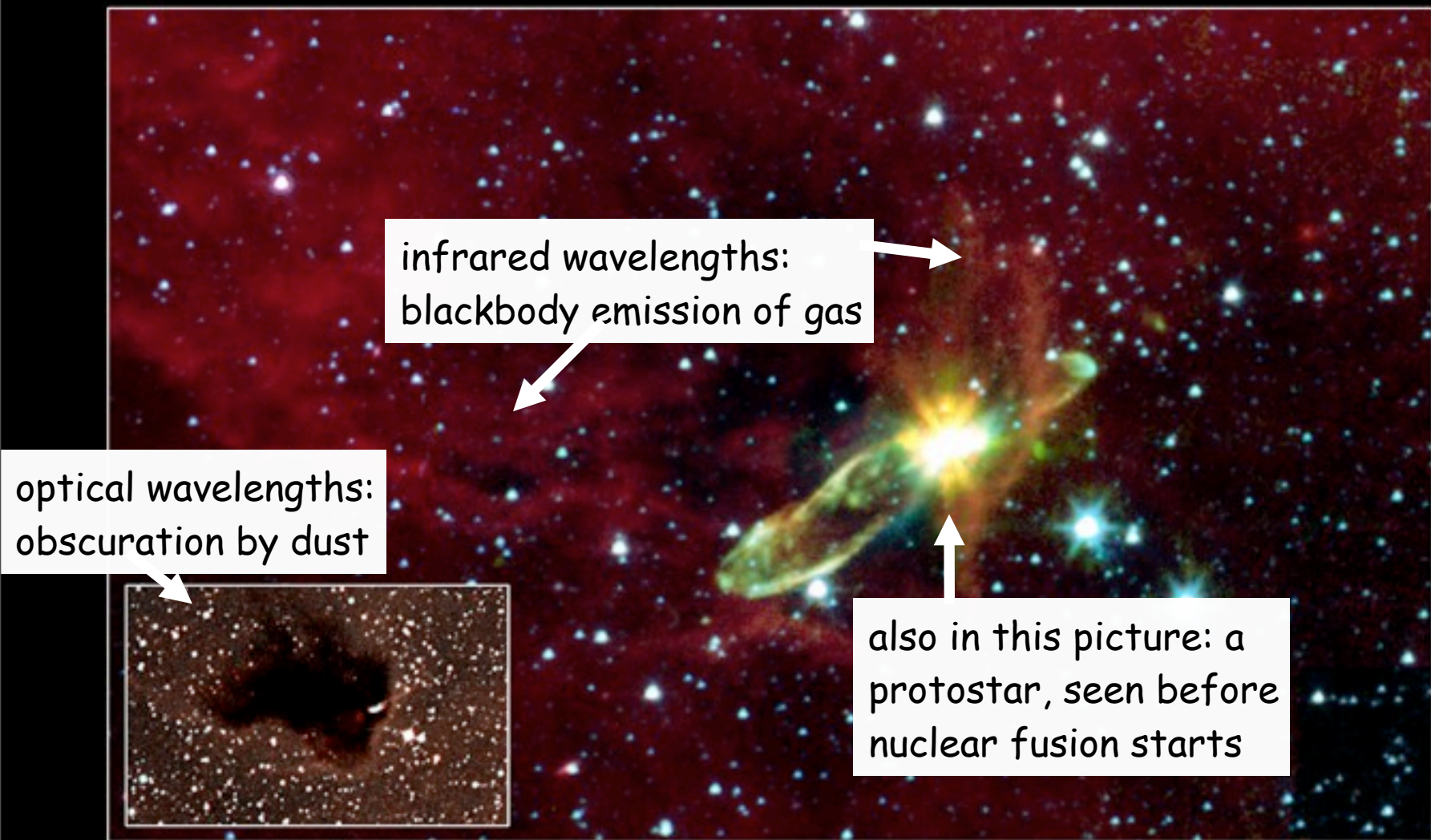




# Astro 220: Galaxies and cosmology

Sep 29, 2010





infrared wavelengths:  
blackbody emission of gas

optical wavelengths:  
obscuration by dust

also in this picture: a  
protostar, seen before  
nuclear fusion starts

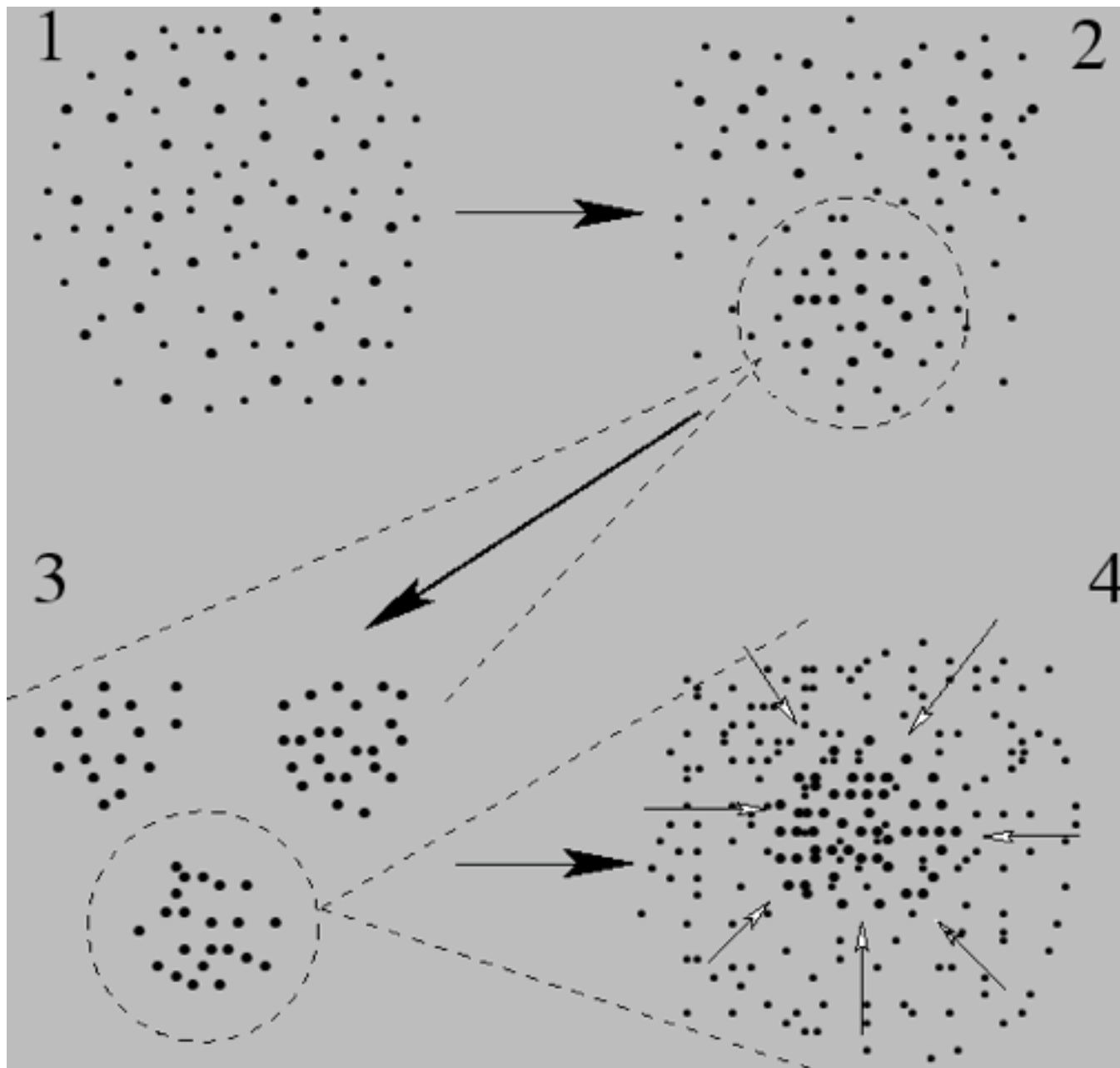
**Embedded Outflow in HH 46/47**

NASA / JPL-Caltech / A. Noriega-Crespo (SSC/Caltech)

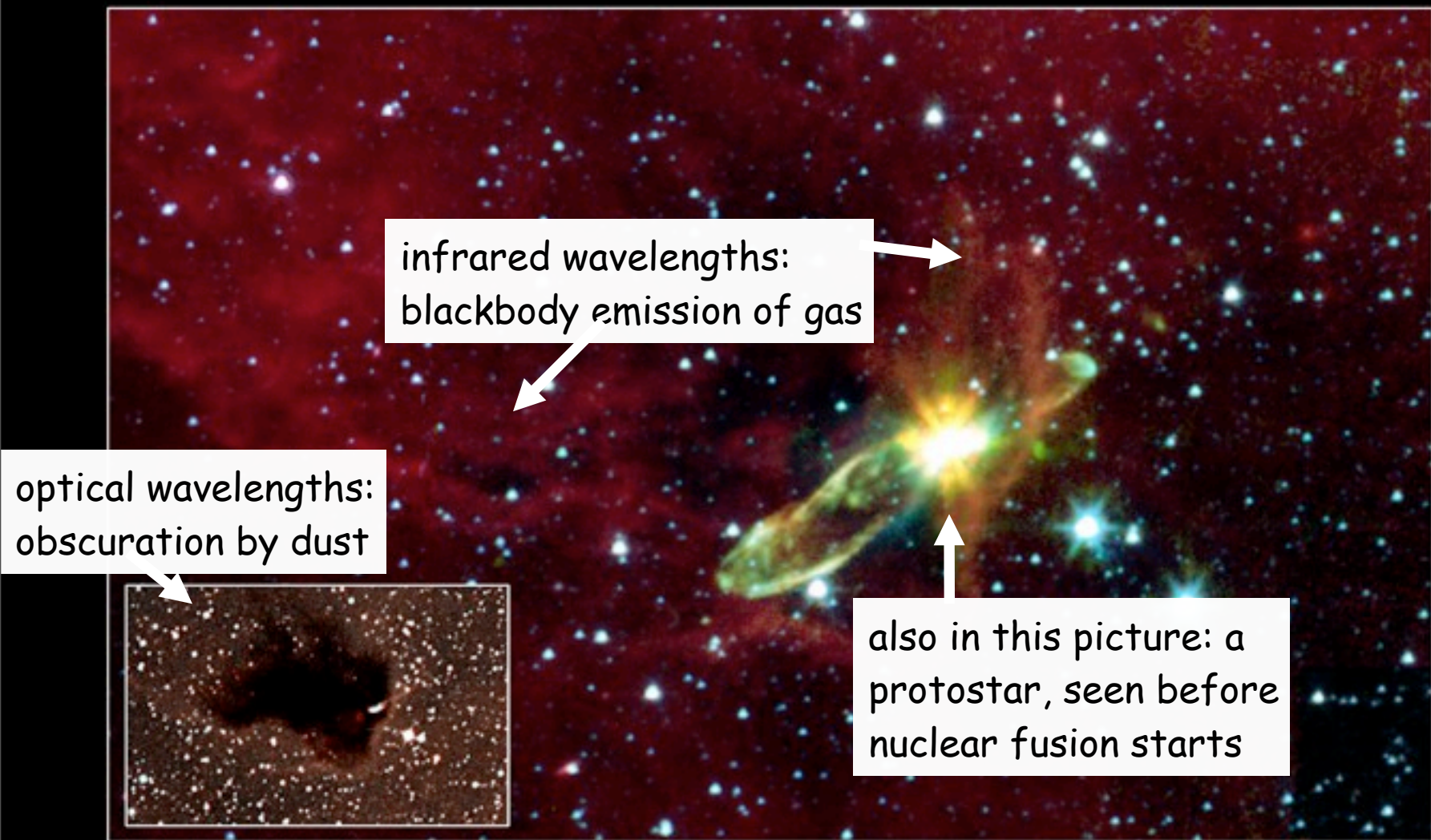
**Spitzer Space Telescope • IRAC**

Inset: visible light (DSS)

ssc2003-06f



Fragmentation of molecular cloud



**Embedded Outflow in HH 46/47**

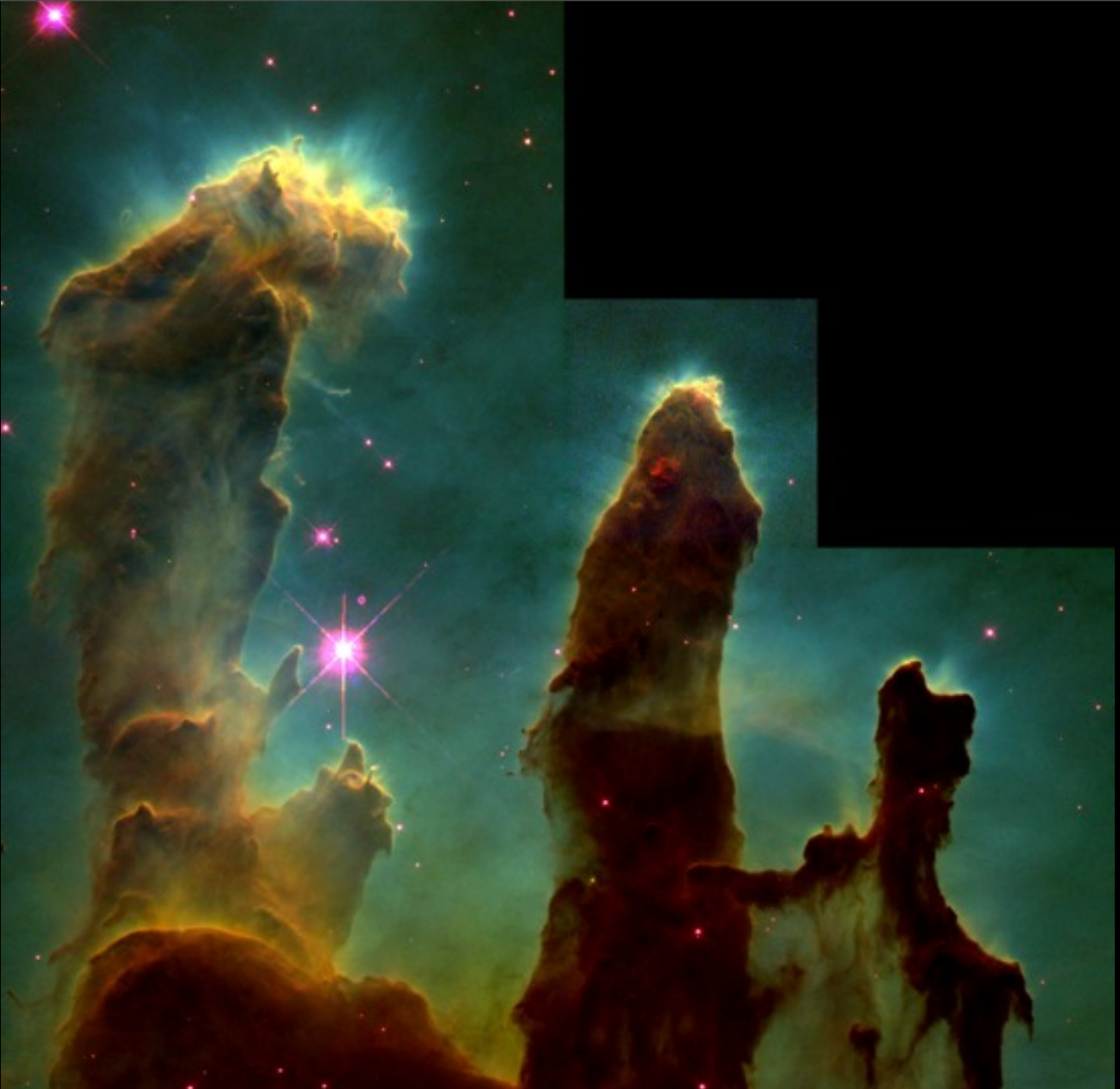
NASA / JPL-Caltech / A. Noriega-Crespo (SSC/Caltech)

**Spitzer Space Telescope • IRAC**

Inset: visible light (DSS)

ssc2003-06f





Monday, October 4, 2010



Monday, October 4, 2010

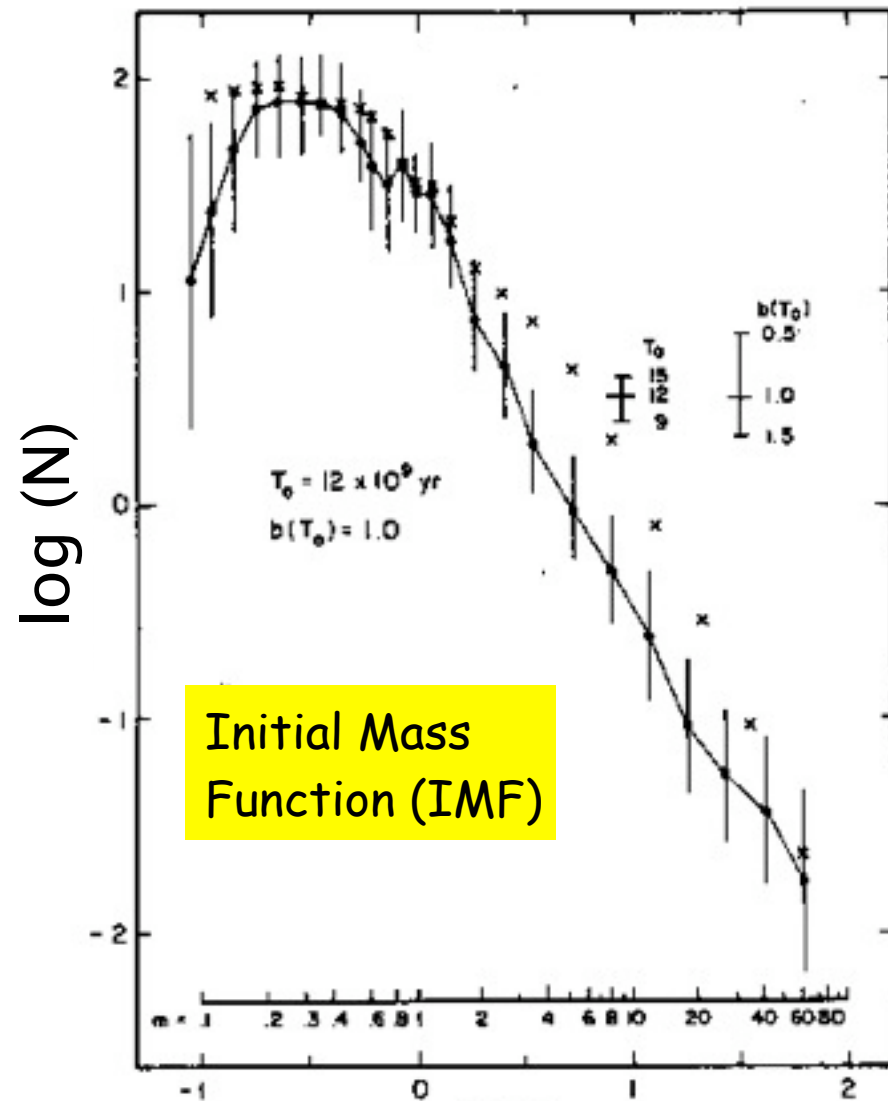
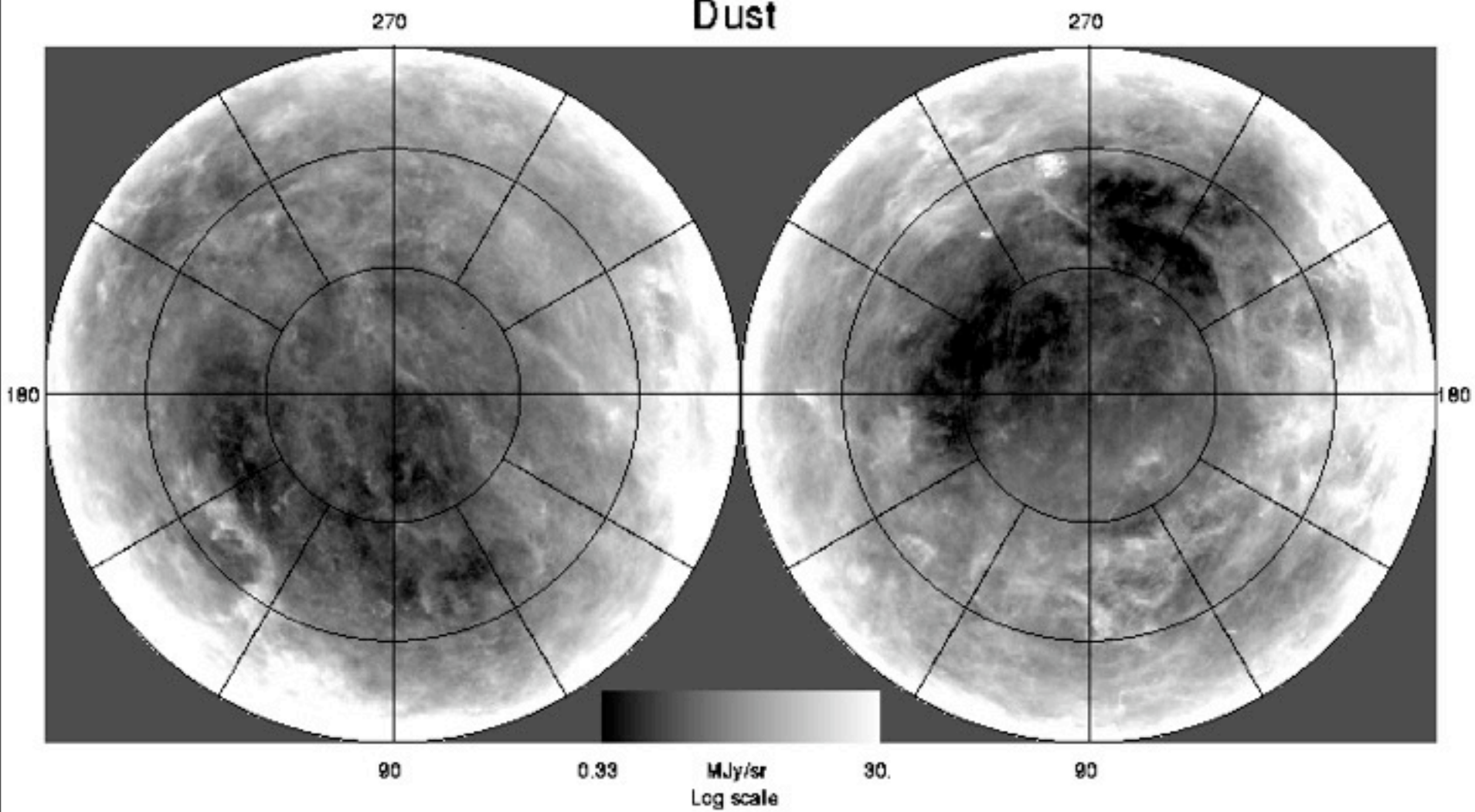


FIGURE 16 Derived field star birthrate  $b(T_0)$  and disk age  $T_0$ , which represent the IMF derived in Miller and Scalo (1979).

$\log(\text{mass})$

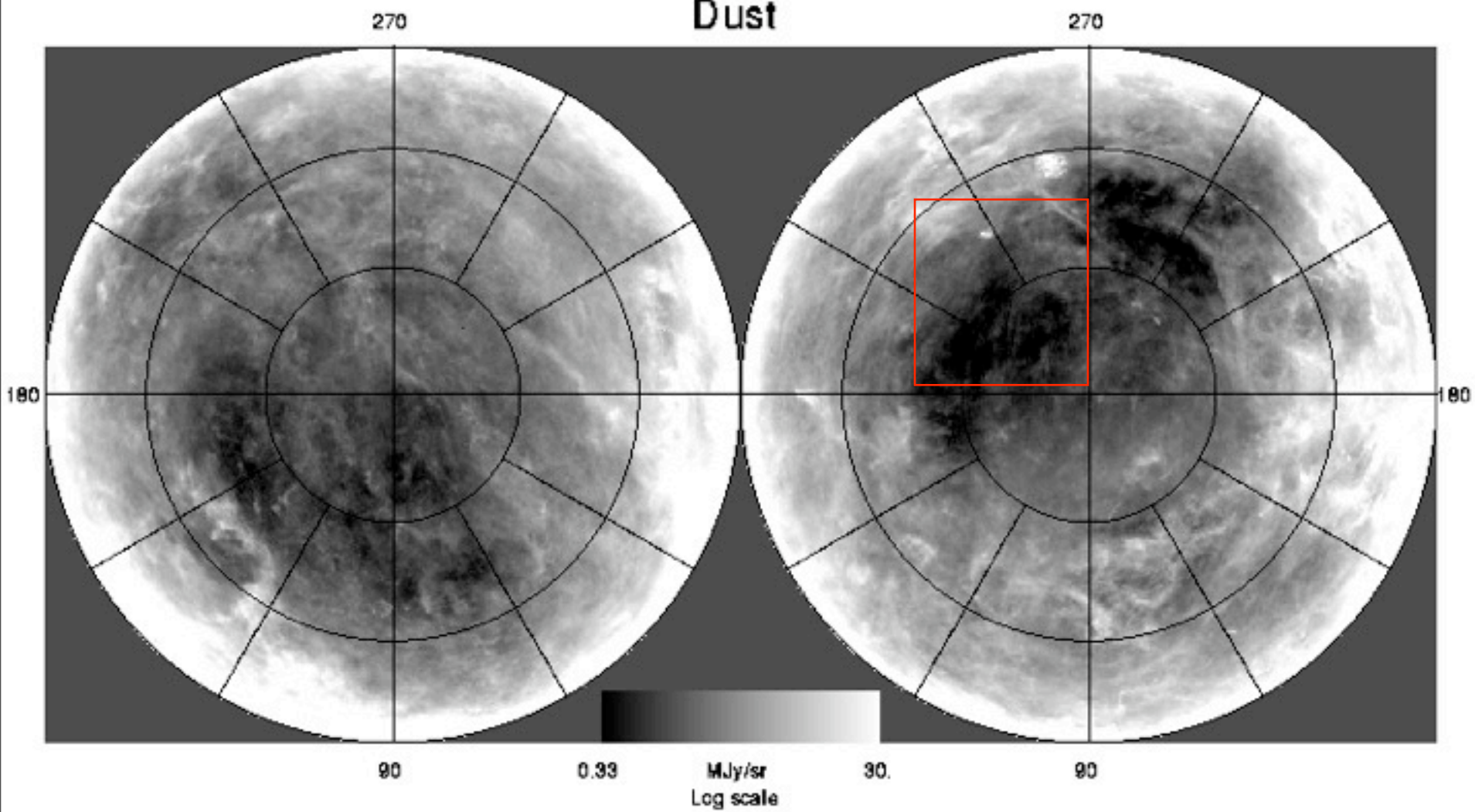
do not include relative figure. Crosses represent

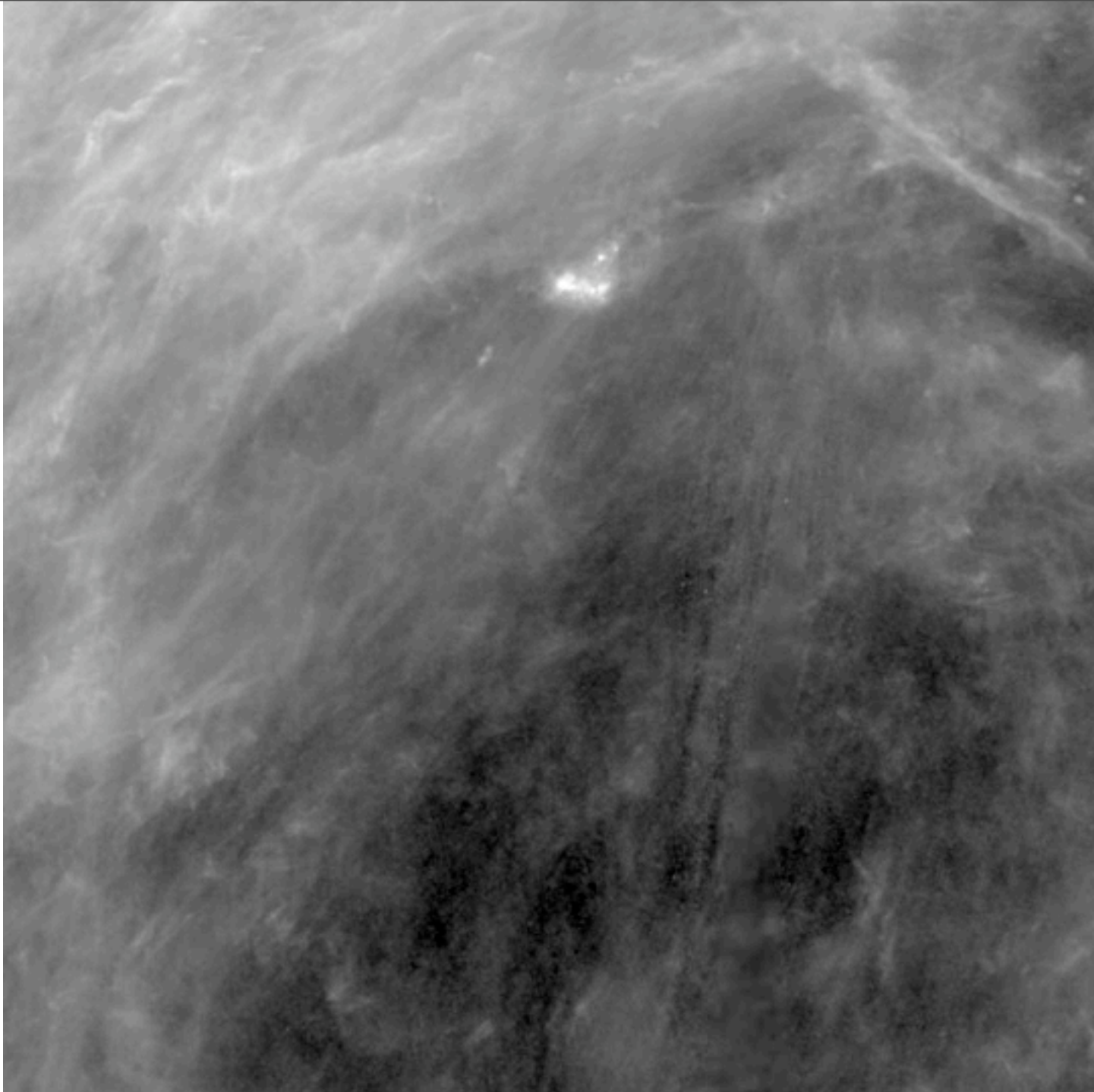
# Dust





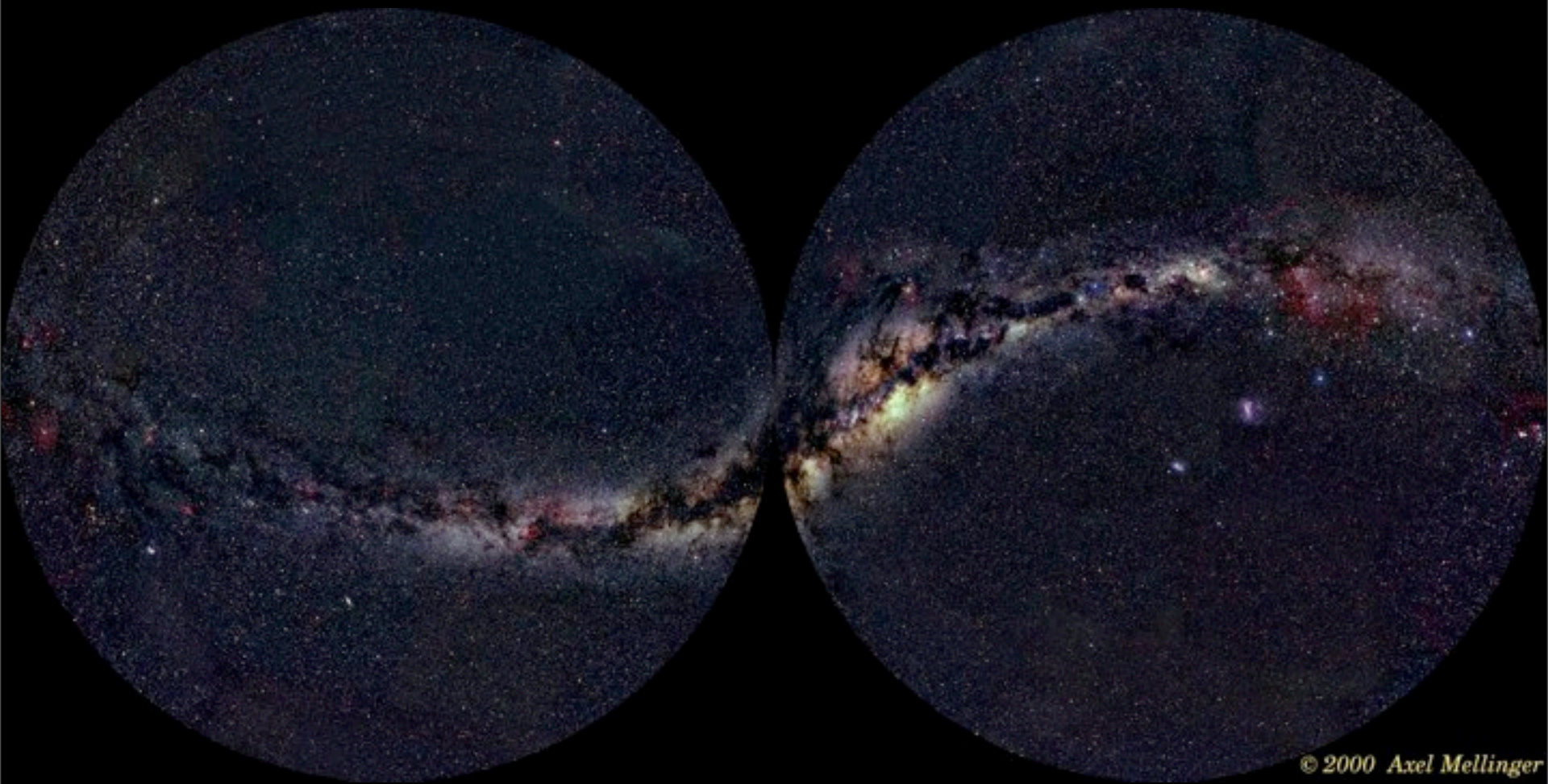
# Dust





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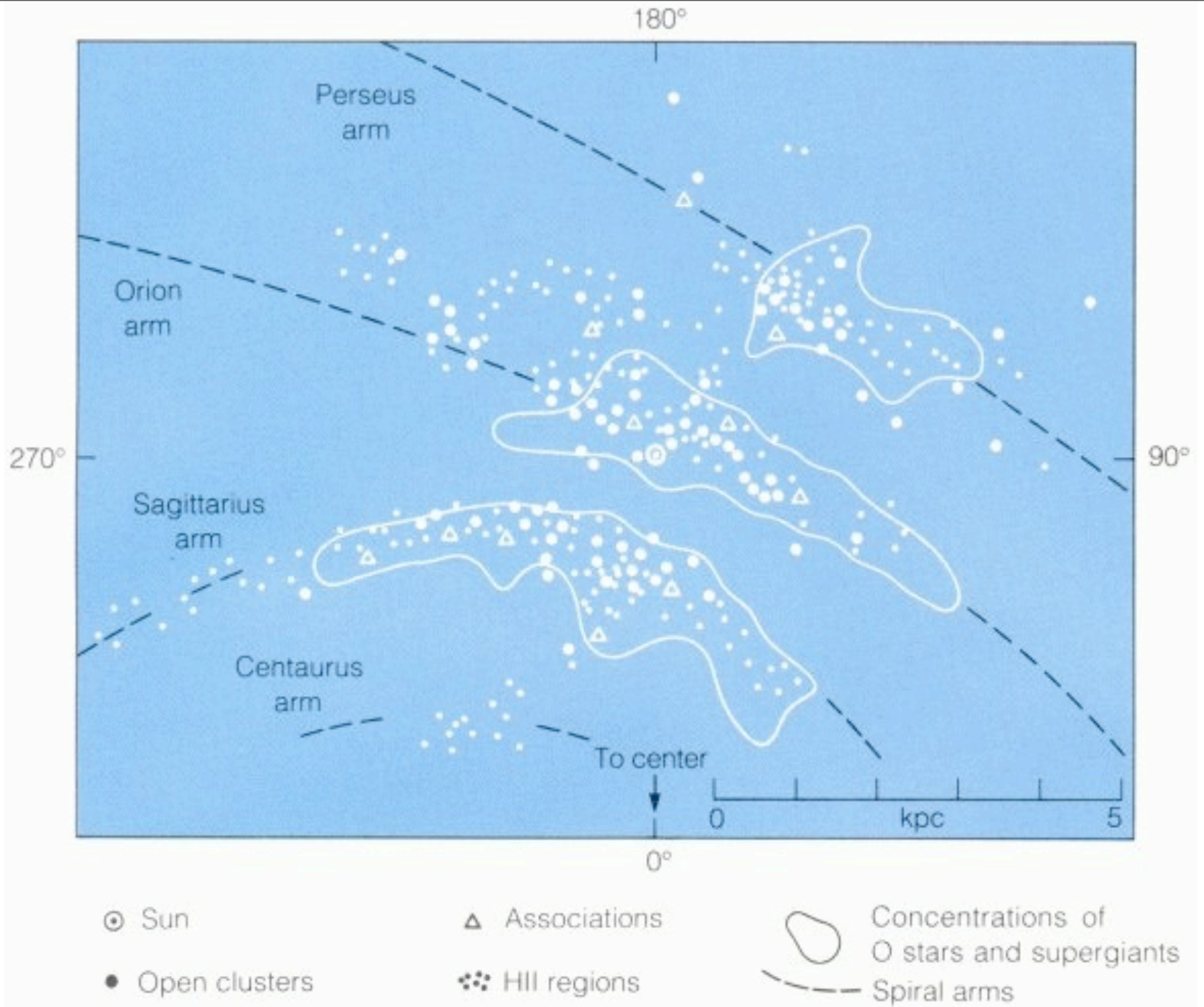
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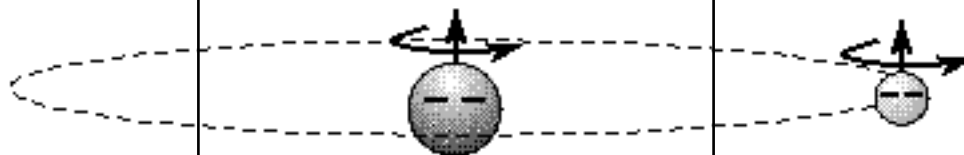


**The Infrared Milky Way** This map of the infrared sky includes the light of a half billion stars





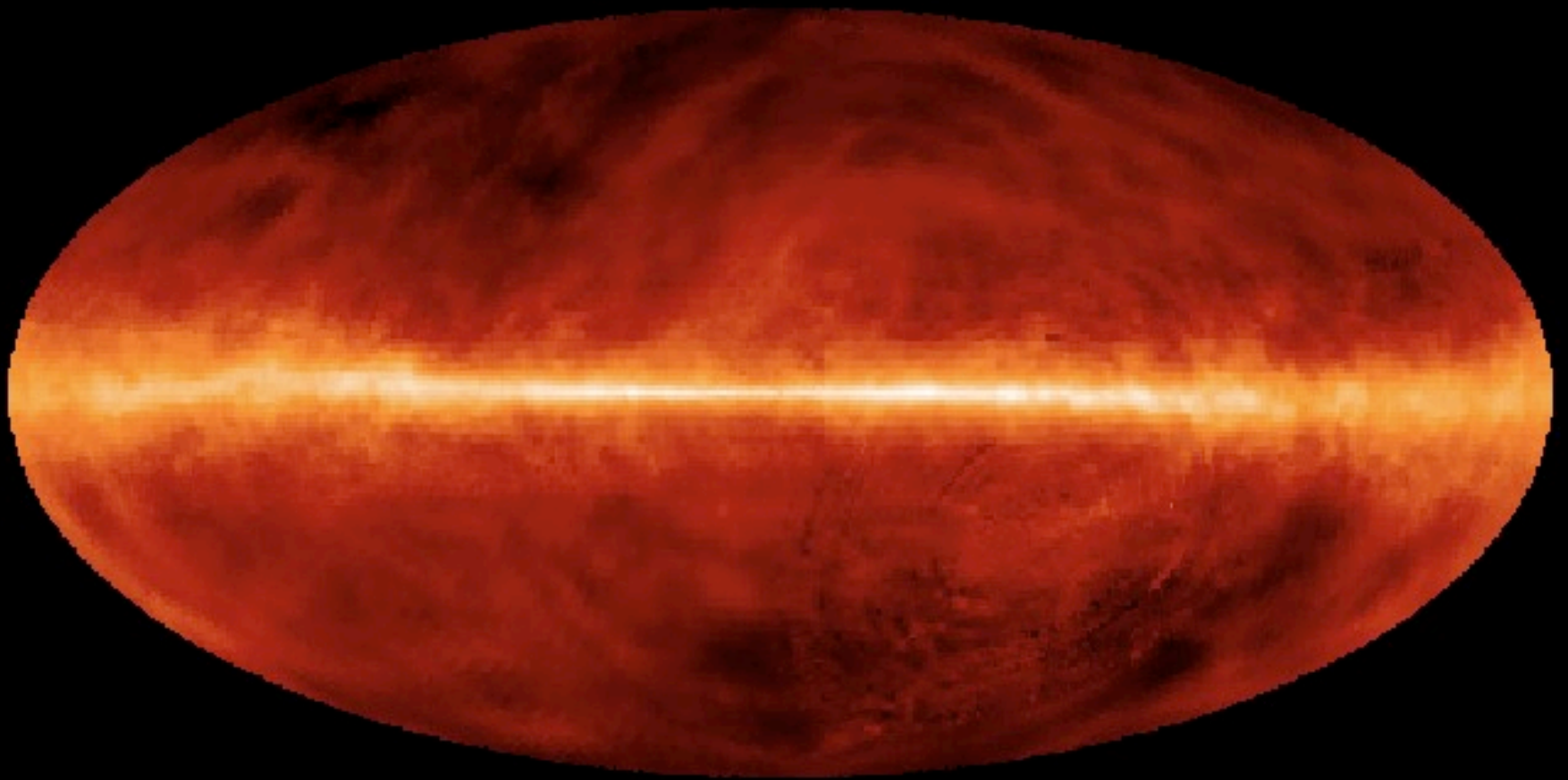
Neutral atomic Hydrogen creates 21 cm radiation



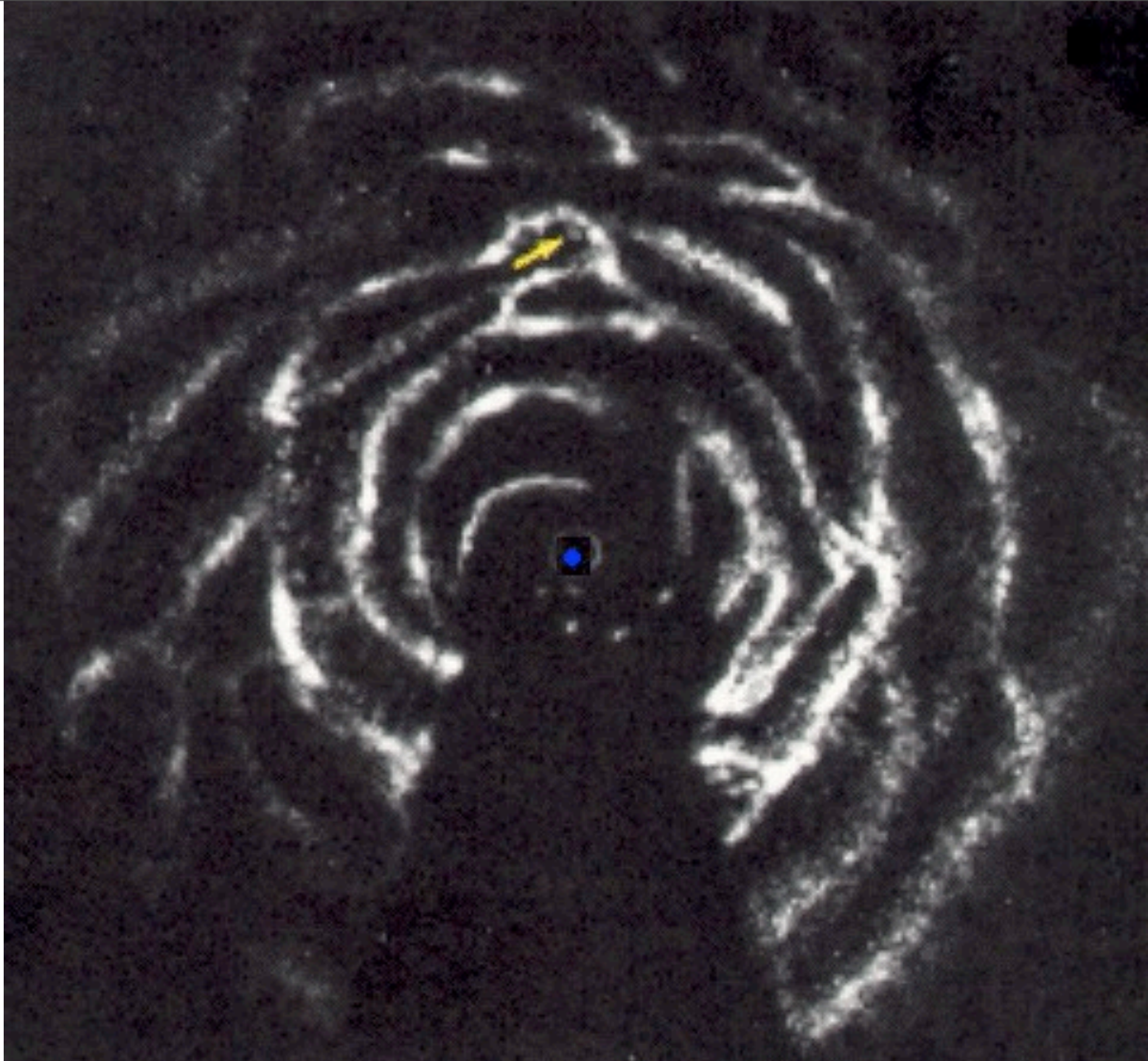


Monday, October 4, 2010





Neutral Hydrogen (21 cm radiation)



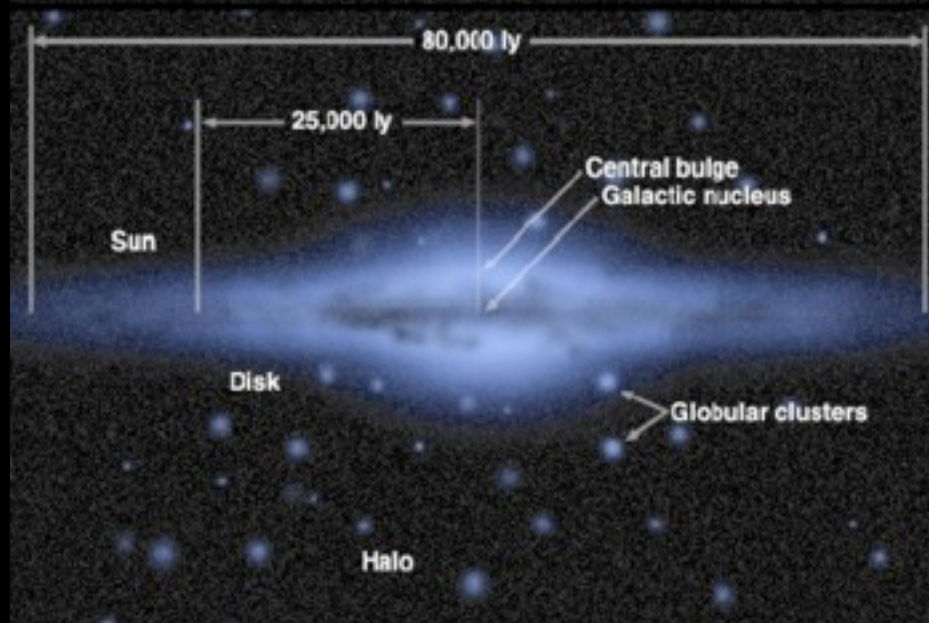
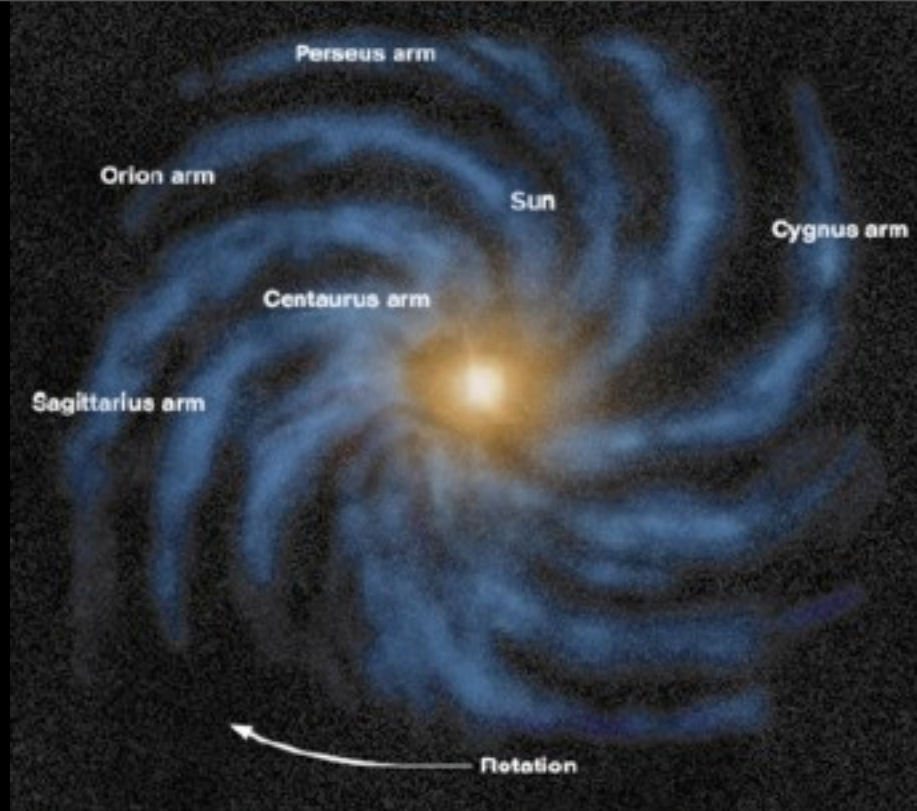
Monday, October 4, 2010





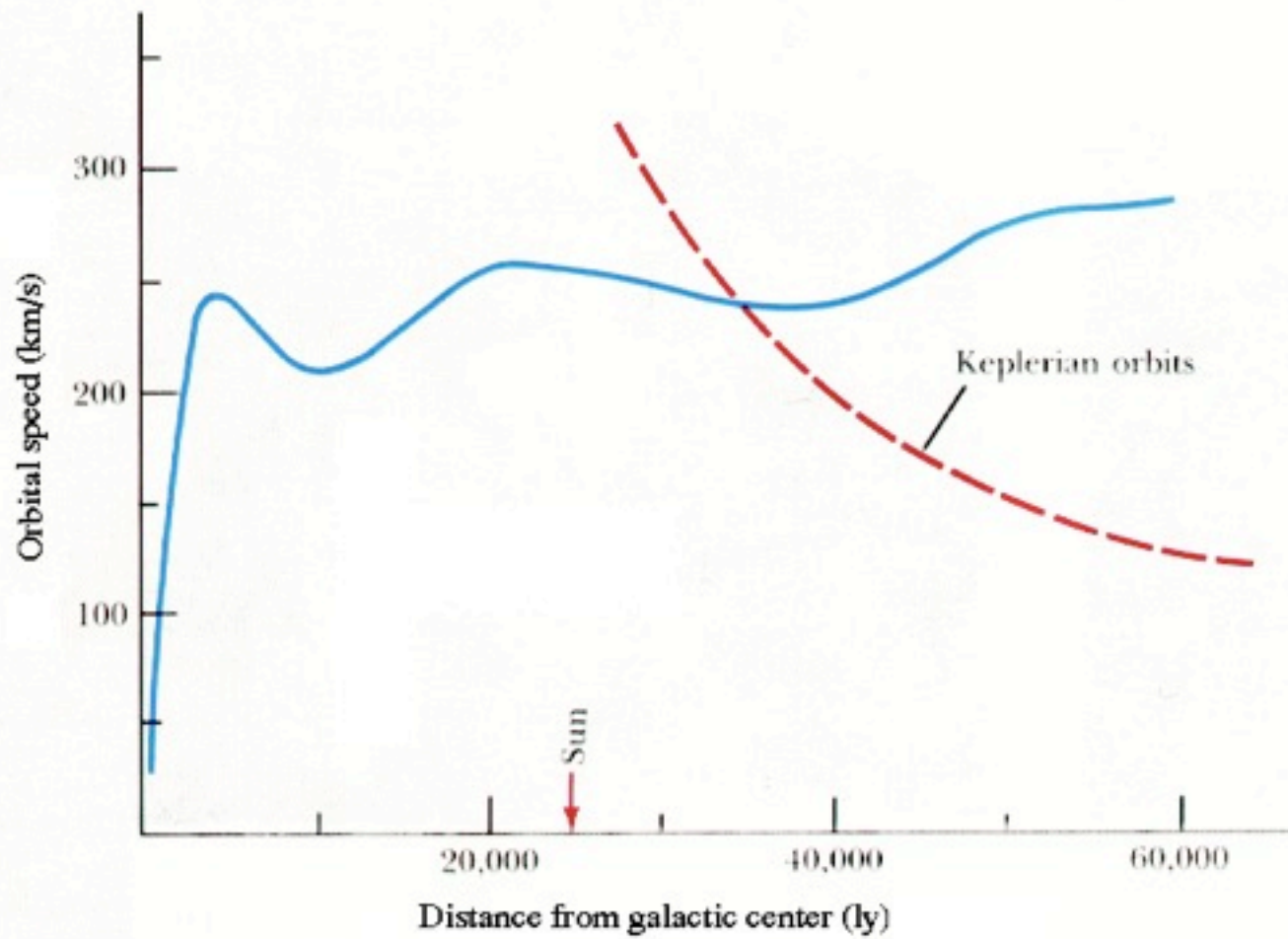
© Anglo-Australian Observatory

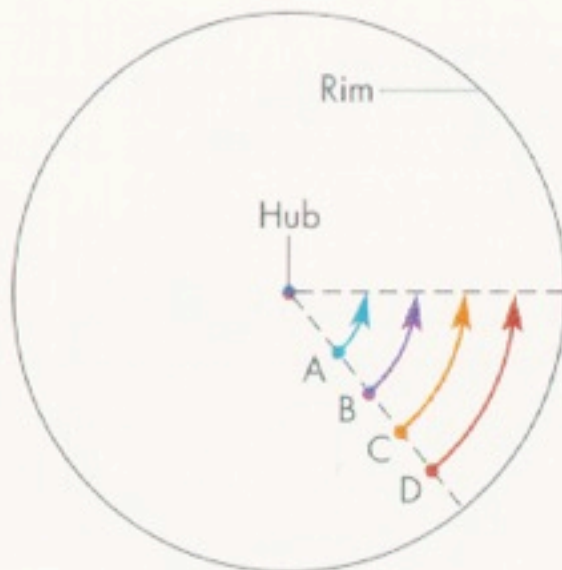




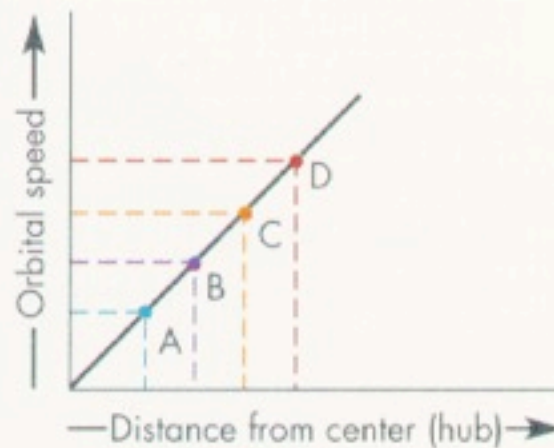




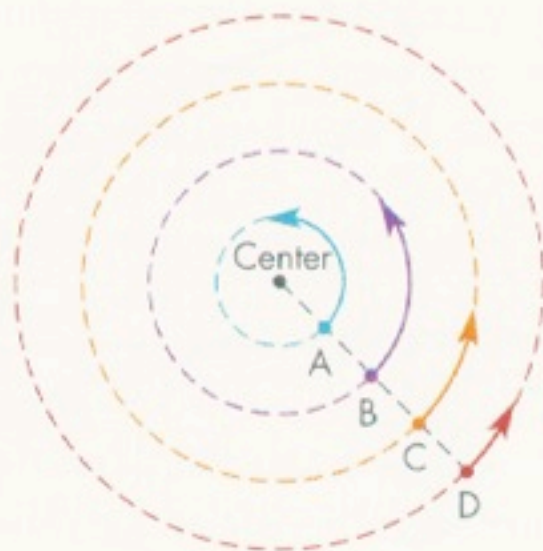




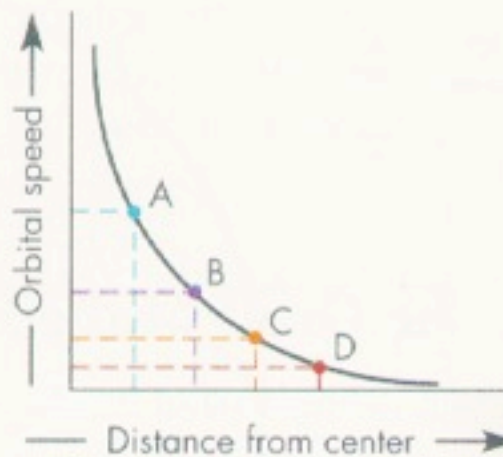
**Wheel-like rotation**



**Rotation curve for wheel-like rotation**

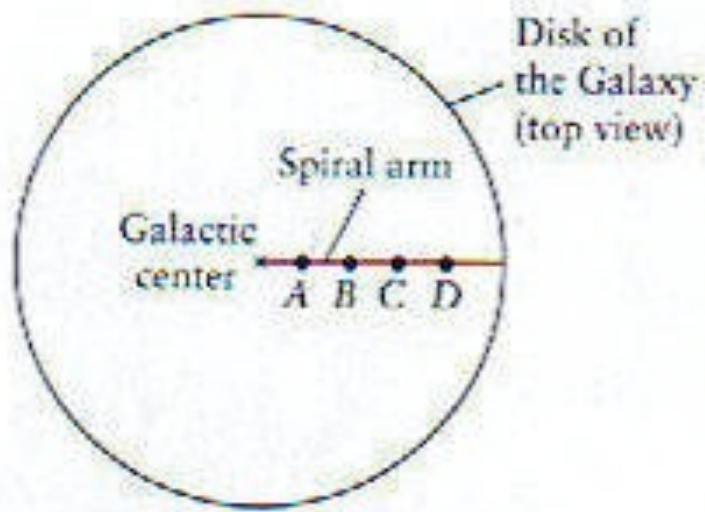


**Planet-like rotation**

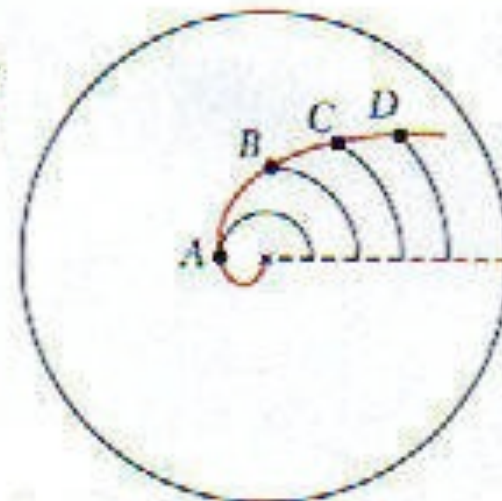


**Rotation curve for planet-like rotation**

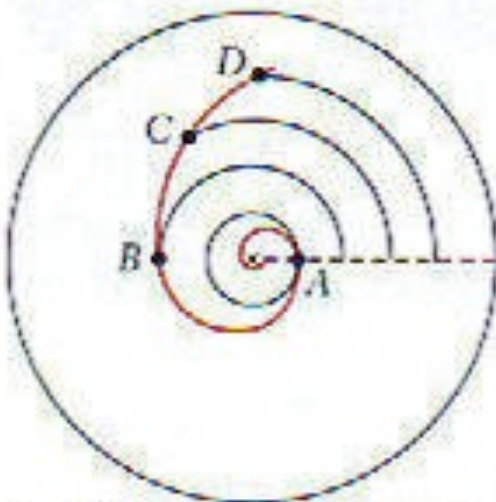




a



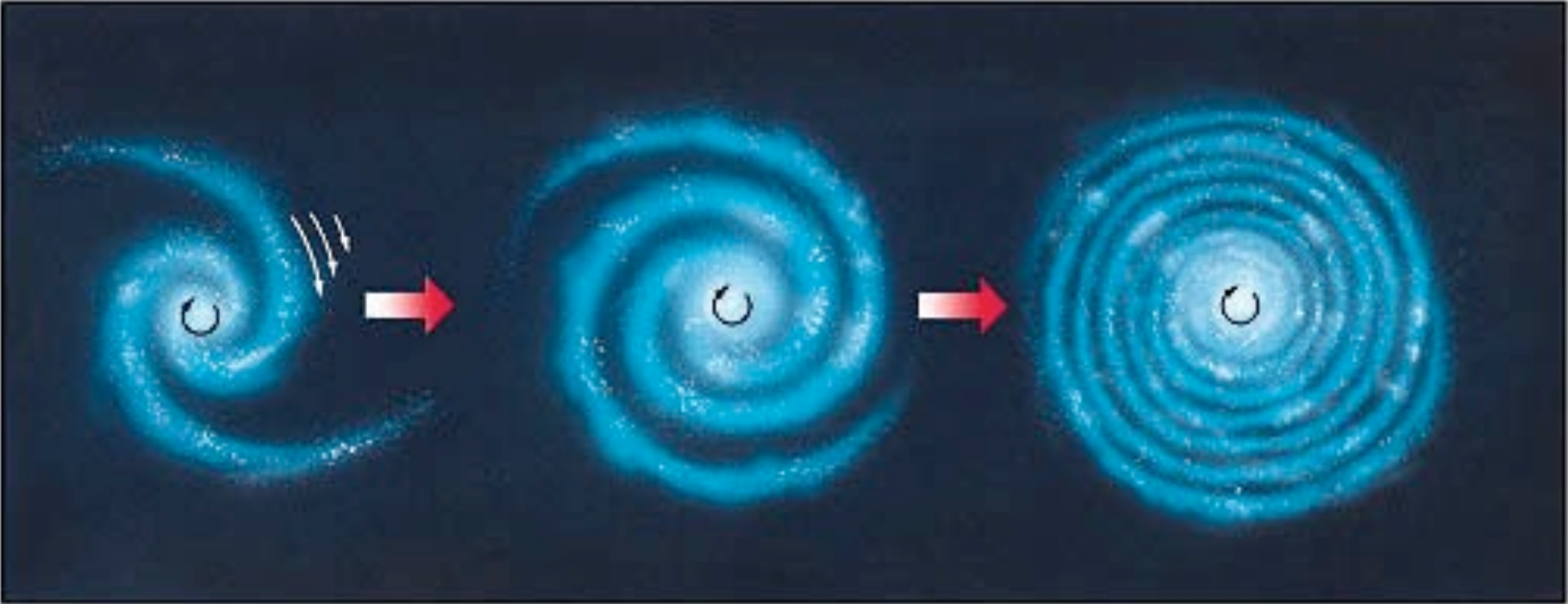
b After  $\frac{1}{2}$  orbit of star A



c After one orbit of star A



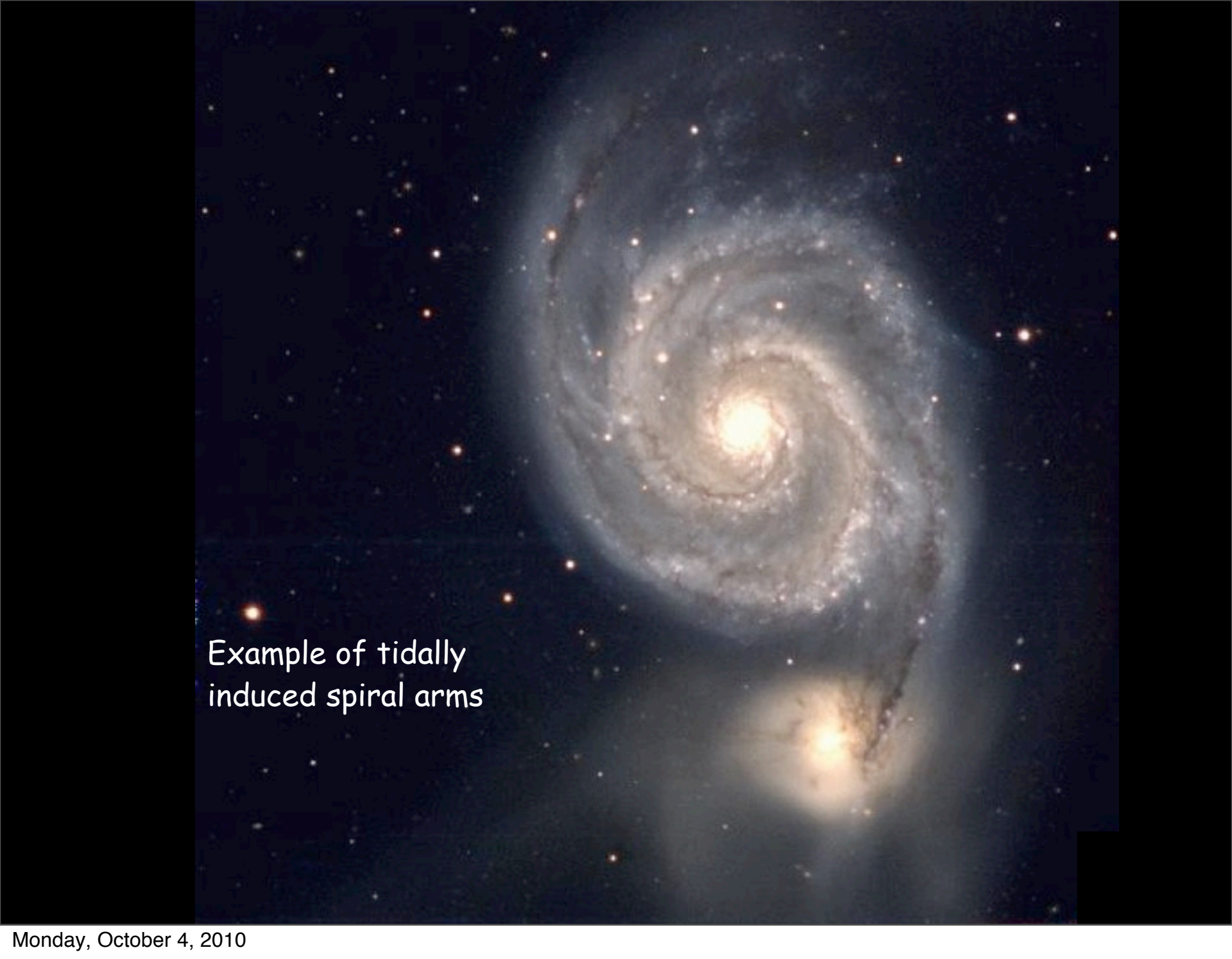
d After two orbits of star A



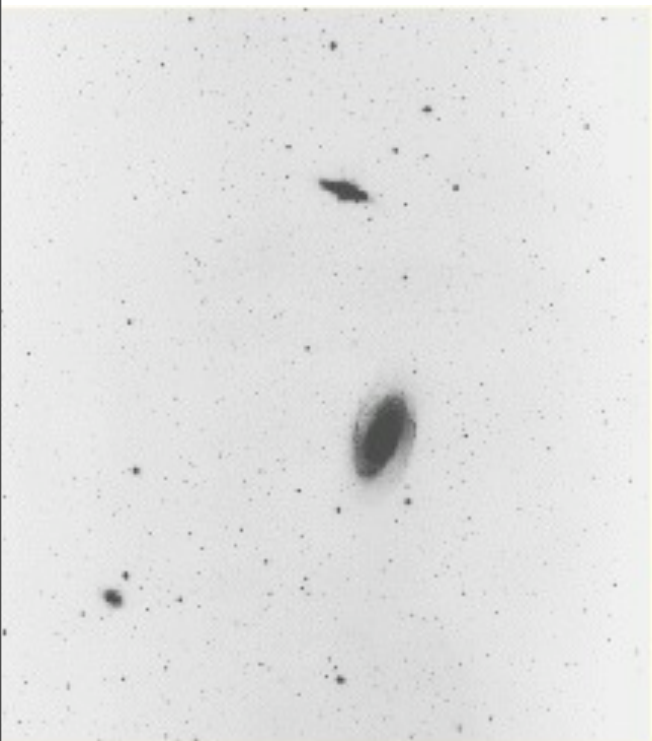




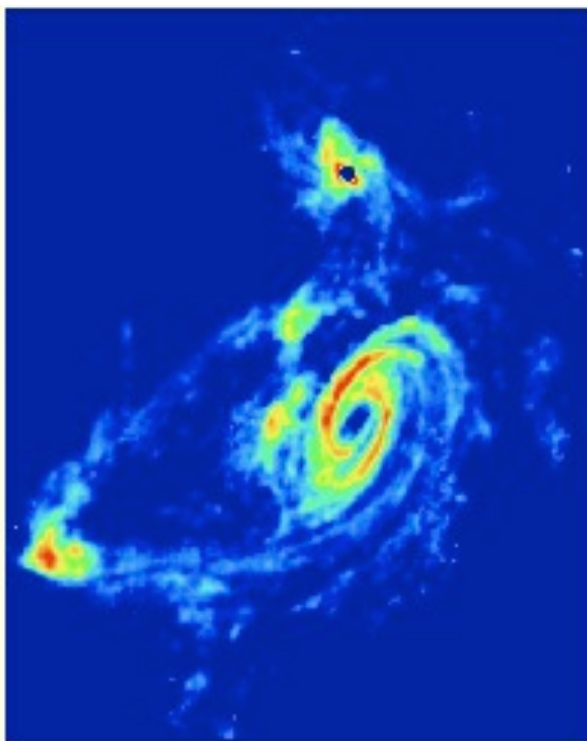
"Flocculent" spiral galaxy: no clear pattern



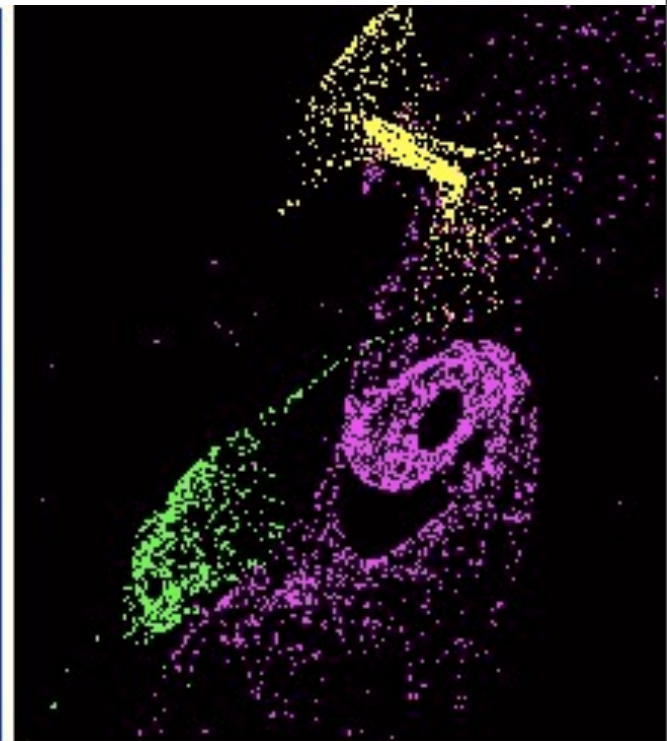
Example of tidally  
induced spiral arms



visual



radio (21cm)

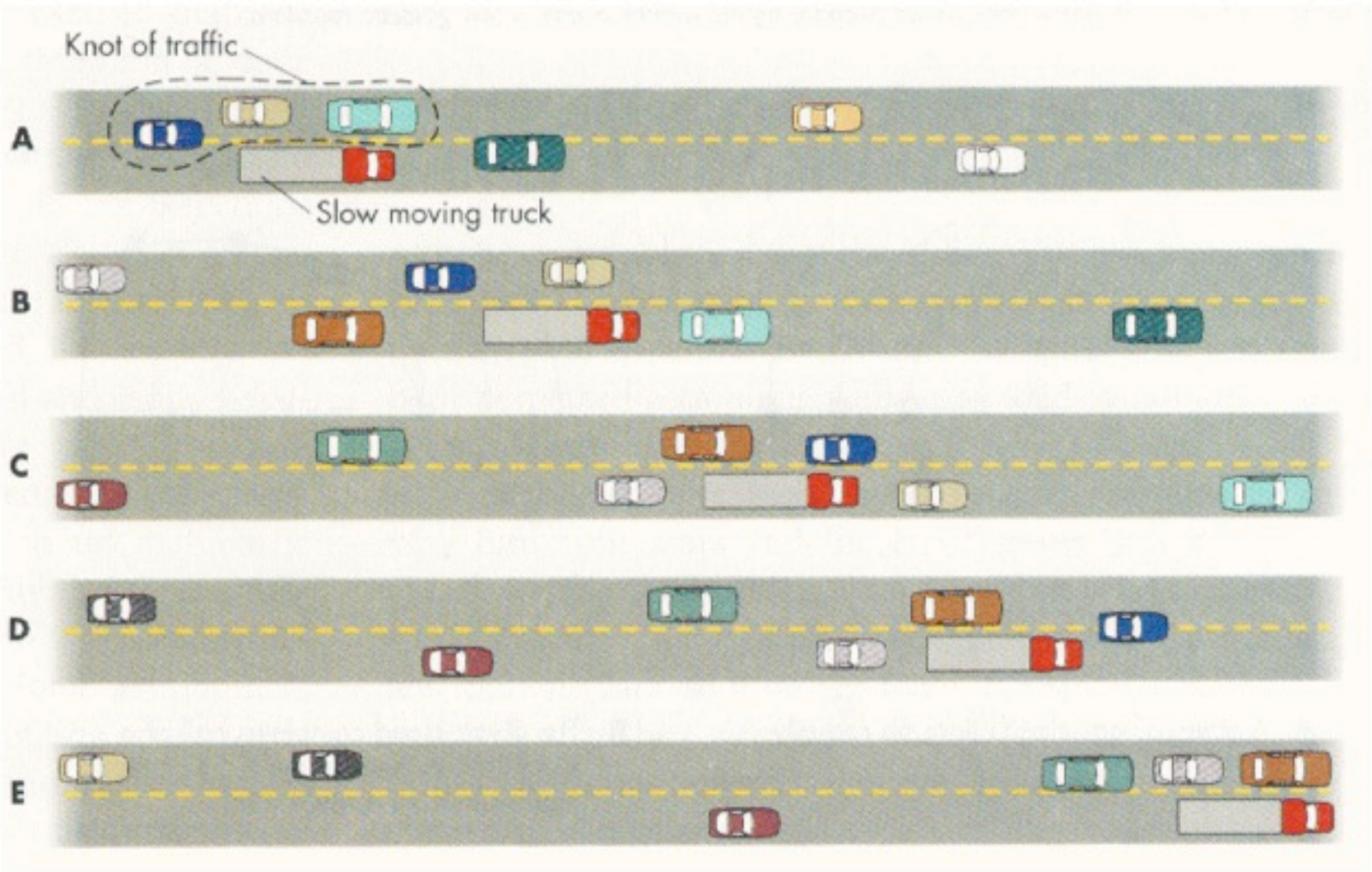


simulation



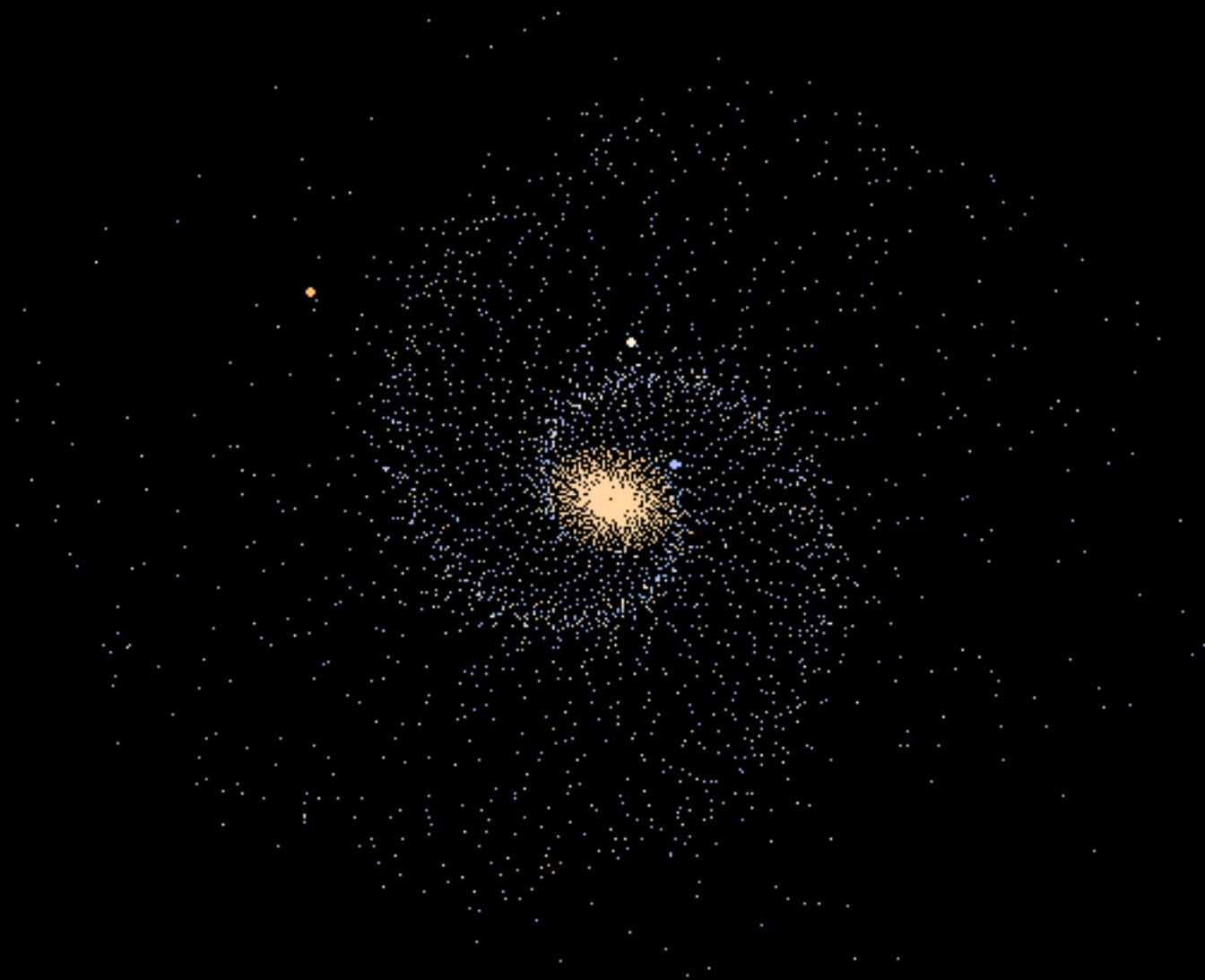
## Density Wave

A slow moving truck causes a knot of traffic that moves along the highway at the speed of the truck. Individual cars approach the traffic knot, slow down as they move carefully through the knot, and then resume speed as they leave the knot. As a result, the traffic knot consists of different cars at different times.



10 Kpc

0 M Years



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