

# Astro I: Introductory Astronomy

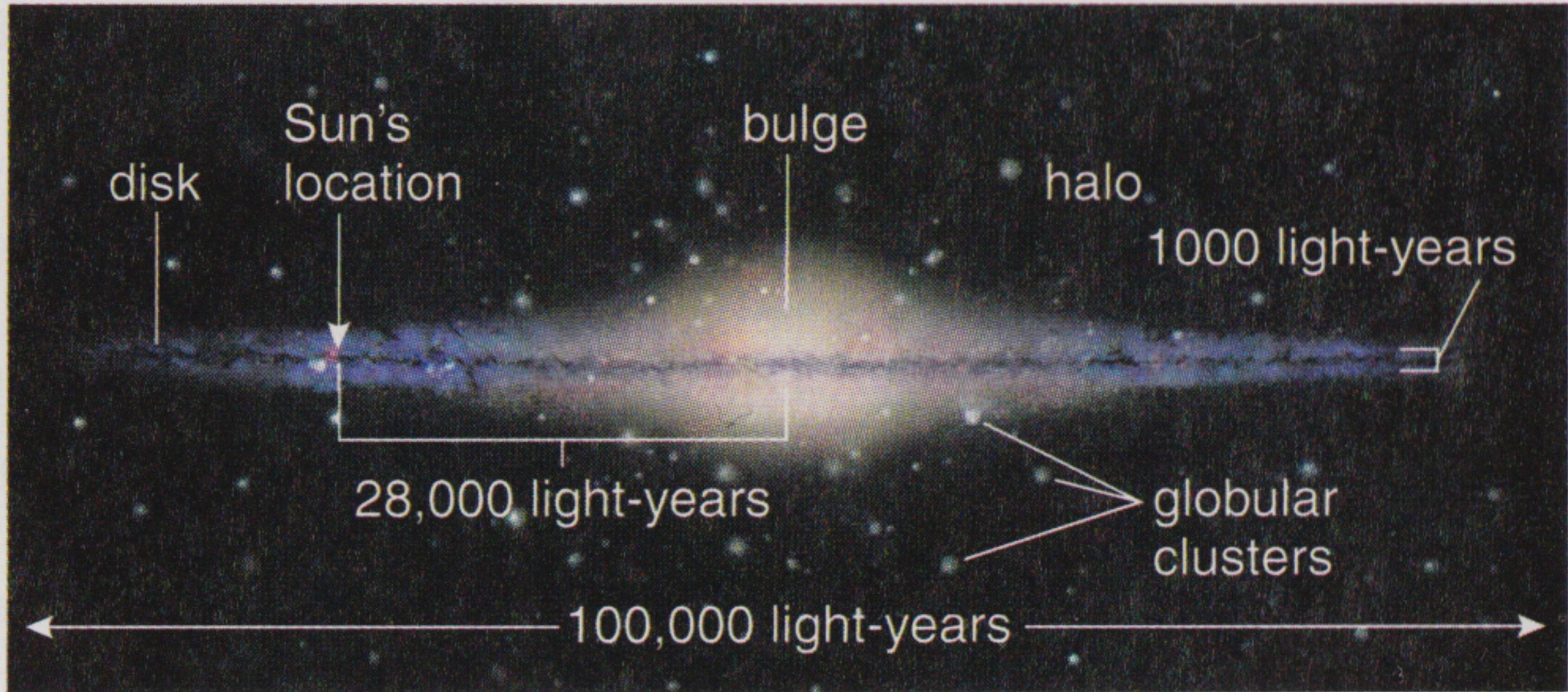




Wally Pacholka / AstroPics.com

<http://apod.nasa.gov/apod/ap130310.html>

Figure 19.1



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



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



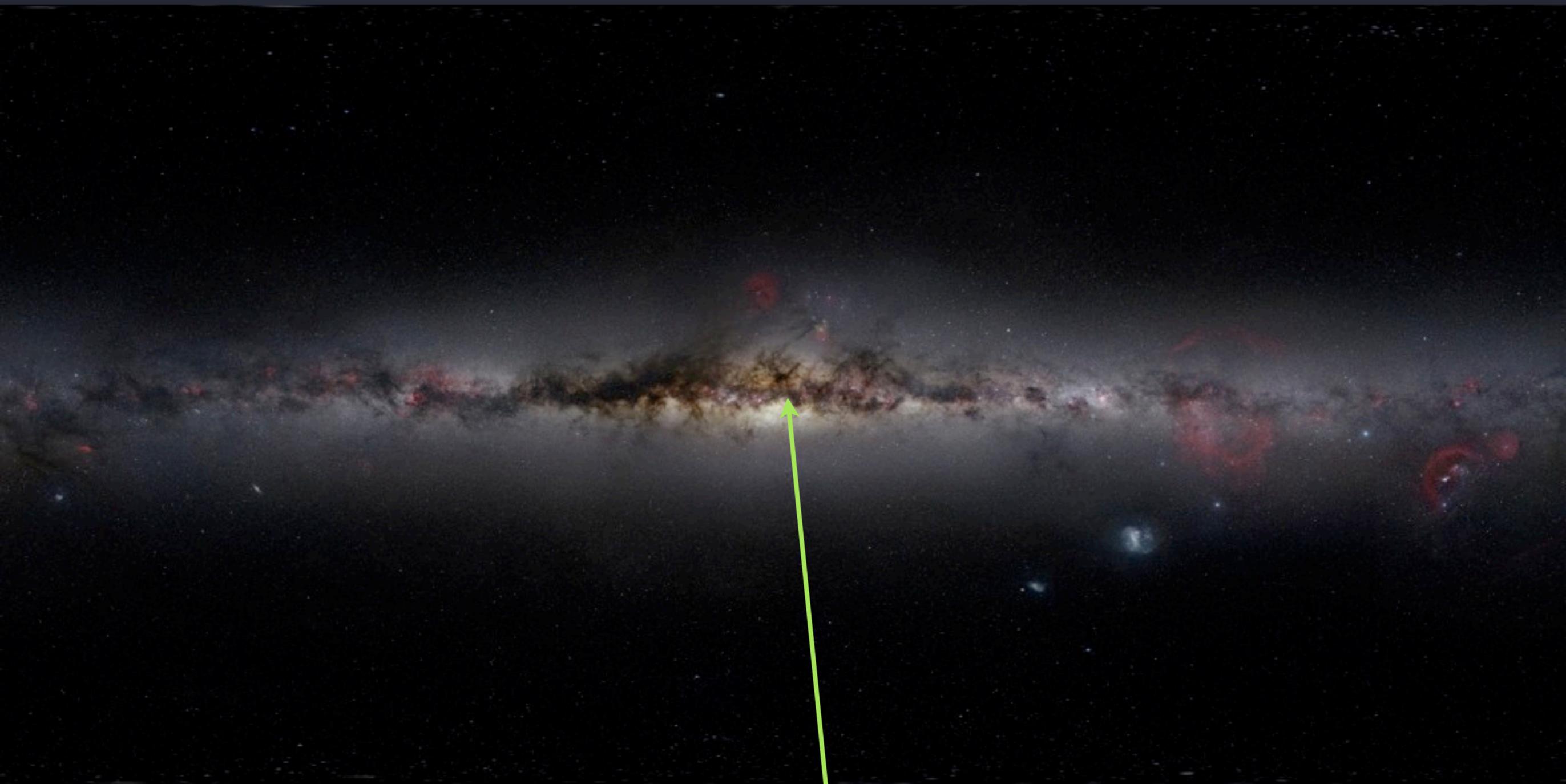
the “coal sack” - opaque  
dust cloud

<http://apod.nasa.gov/apod/ap080707.html>

# Composite of images taken from the Earth's surface



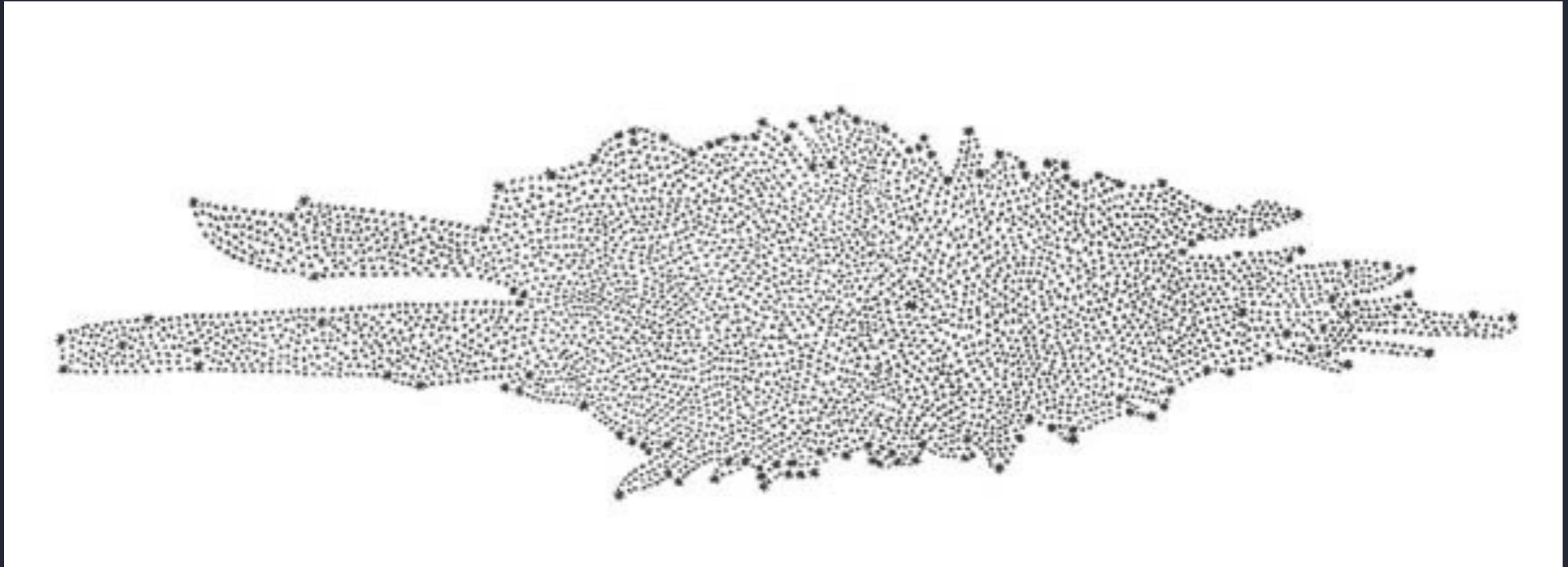
<http://apod.nasa.gov/apod/ap110520.html>



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Galactic center

# 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.

## Two open clusters - relatively young



The smaller a cluster looks, the farther away it should be

Consider two open clusters, X and Y

The stars in cluster X  
are, on average, 4 times  
brighter than the stars  
in cluster Y



Which cluster is farther away, X or Y?

How many times farther away is it?

Consider two open clusters, X and Y

The stars in cluster X  
are, on average, 4 times  
brighter than the stars  
in cluster Y



Which cluster is farther away, X or Y?

Y is farther away

How many times farther away is it?

It is 2 times farther away

Consider two open clusters, X and Y

The stars in cluster X are, on average, 4 times brighter than the stars in cluster Y



So if cluster X is one degree across, what should the angular size of Y be?

Consider two open clusters, X and Y

The stars in cluster X are, on average, 4 times brighter than the stars in cluster Y



So if cluster X is one degree across, what should the angular size of Y be?

2 times farther away, 2 times smaller in angular size: half a degree

Consider two open clusters, X and Y

The stars in cluster X  
are, on average, 4 times  
brighter than the stars  
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2 times farther away, 2 times smaller in  
angular size: half a degree

But what if there is dust making the more  
distant cluster even dimmer? Is it really closer  
or farther than you'd previously estimated?

Consider two open clusters, X and Y

The stars in cluster X  
are, on average, 4 times  
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But what if there is dust making the more  
distant cluster even dimmer? Is it really closer  
or farther than you'd previously estimated?

closer (since some of the dimness is due to  
dust, not distance)

Consider two open clusters, X and Y

The stars in cluster X  
are, on average, 4 times  
brighter than the stars  
in cluster Y



So, will the cluster be bigger or smaller than half  
a degree?

Consider two open clusters, X and Y

The stars in cluster X  
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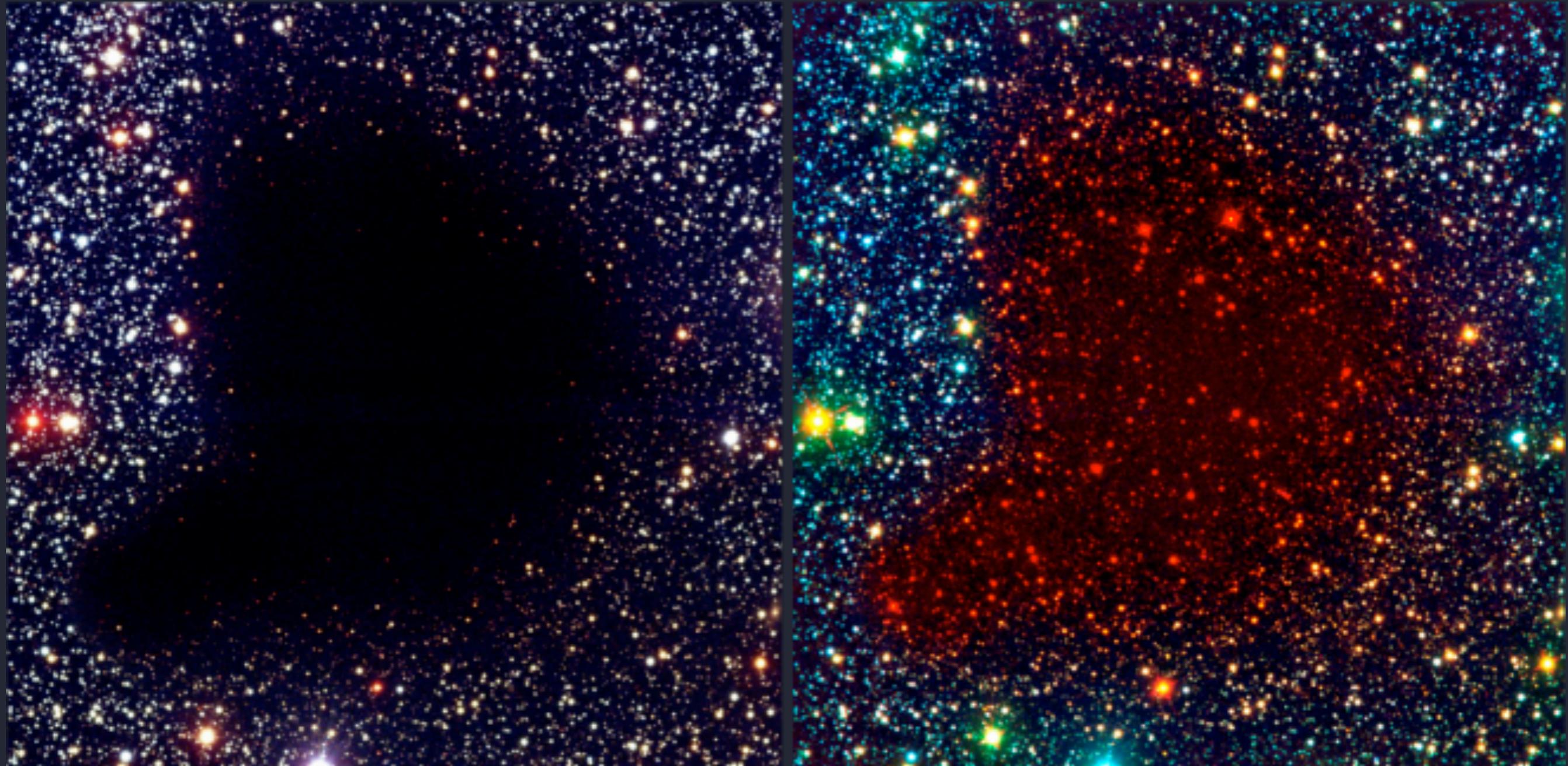


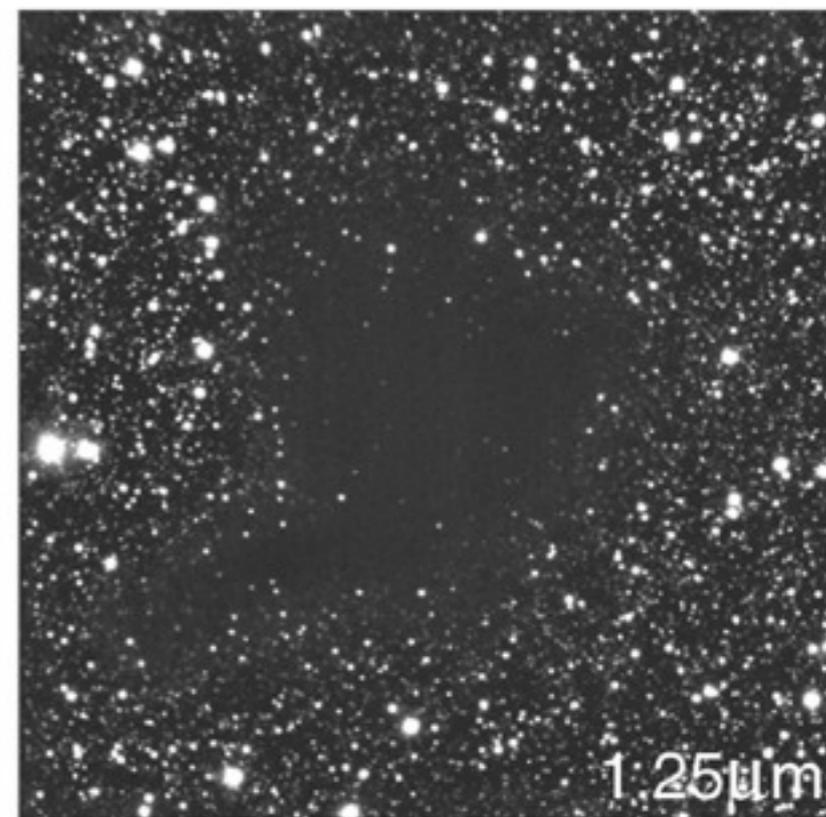
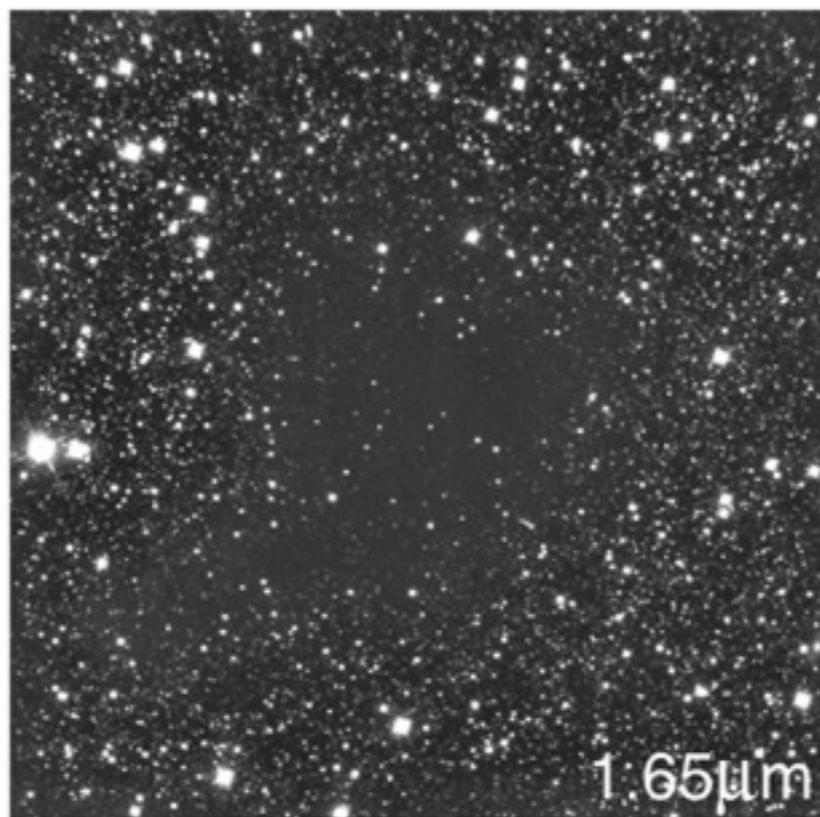
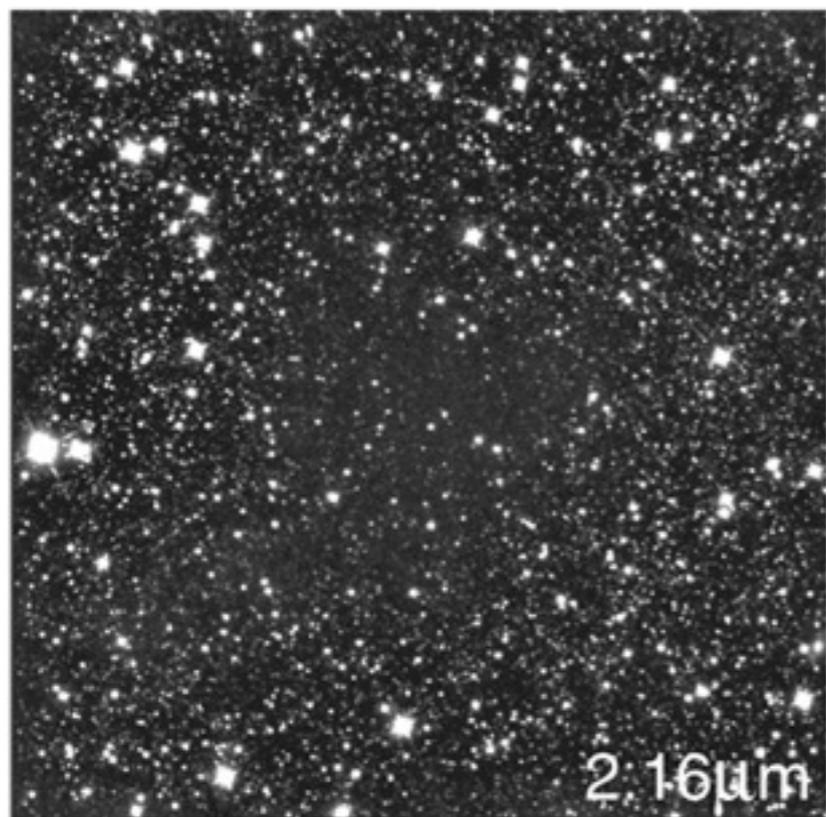
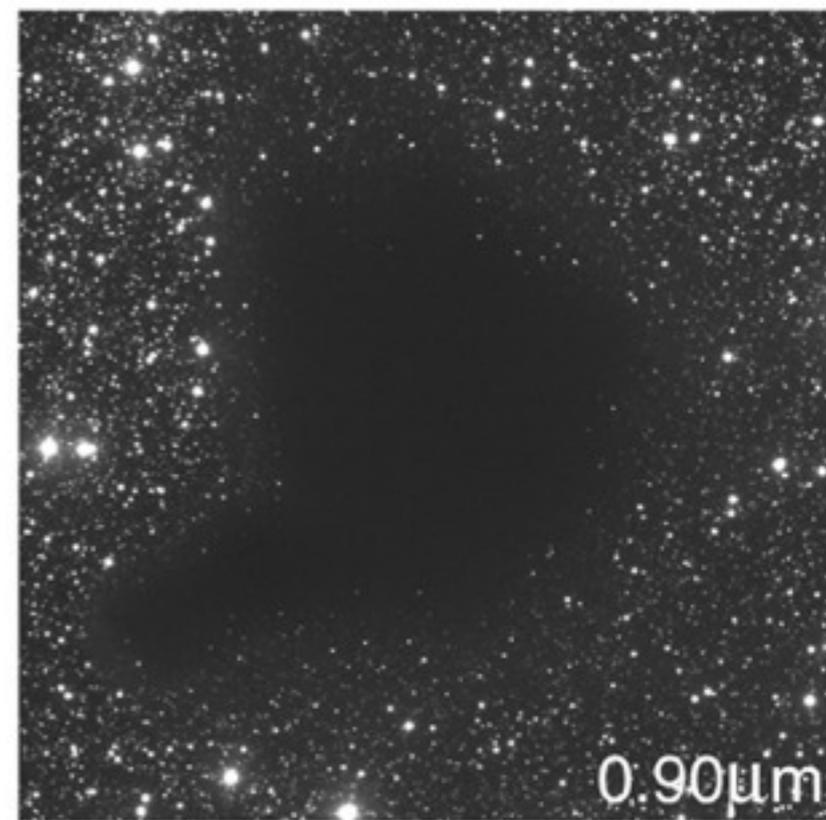
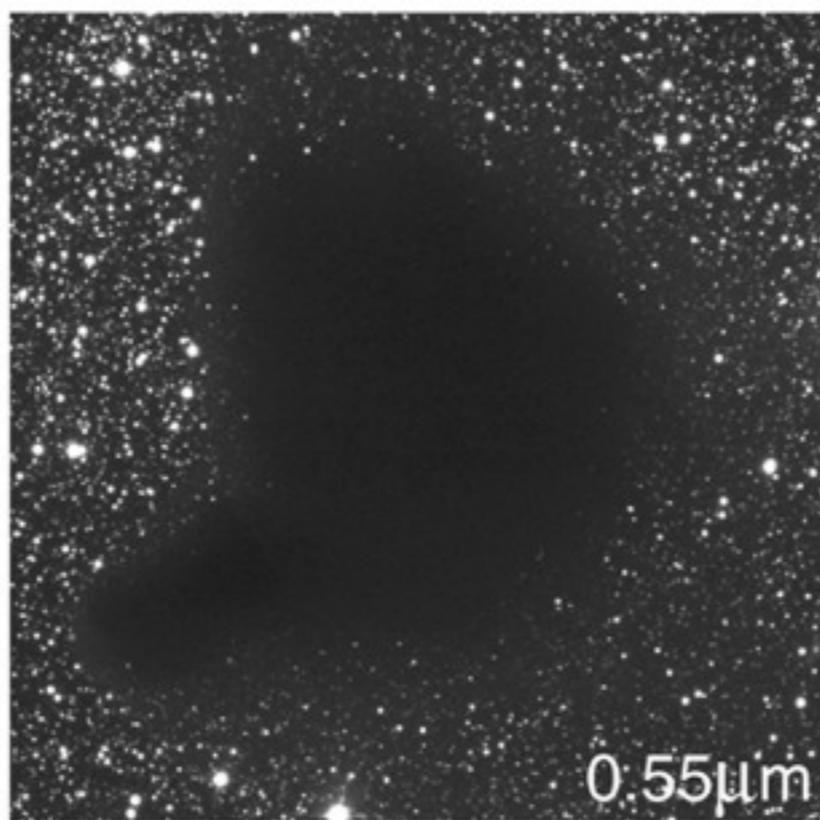
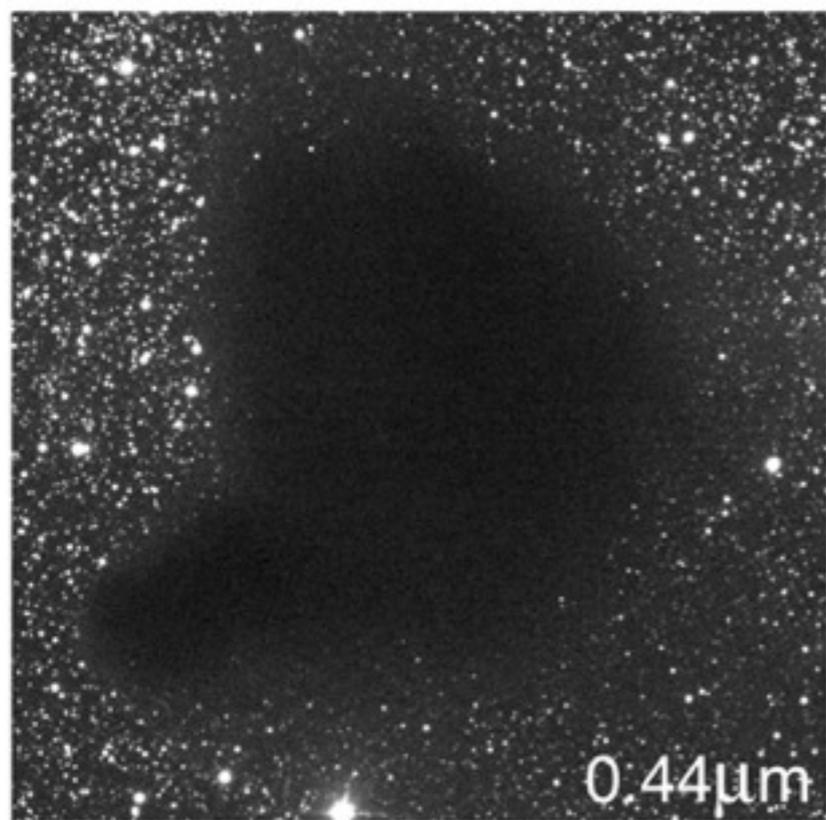
So, will the cluster be bigger or smaller than half  
a degree?

bigger!



Infrared image on the right: dust is more transparent in the infrared



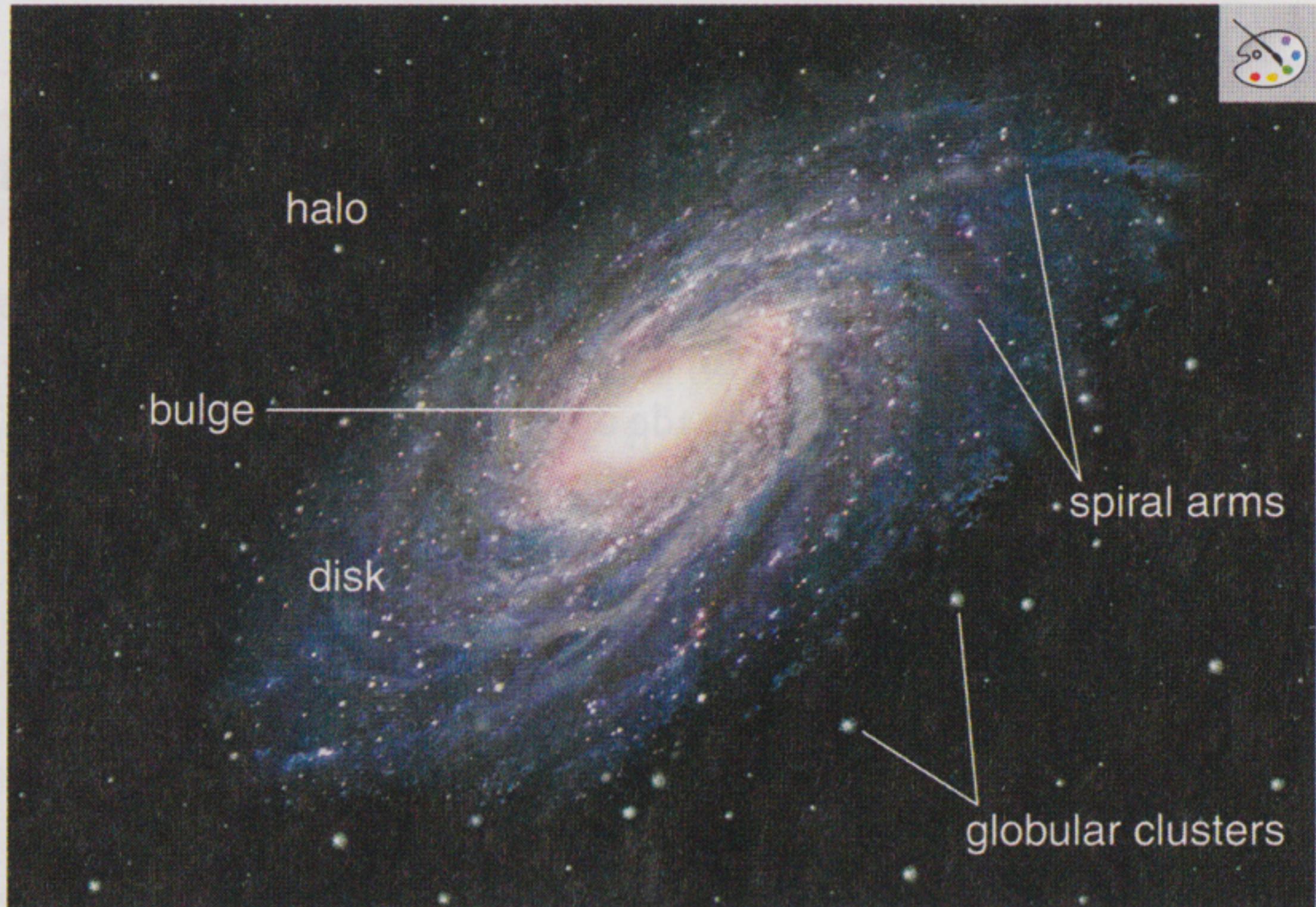


The Dark Cloud B68 at Different Wavelengths (NTT + SOFI)

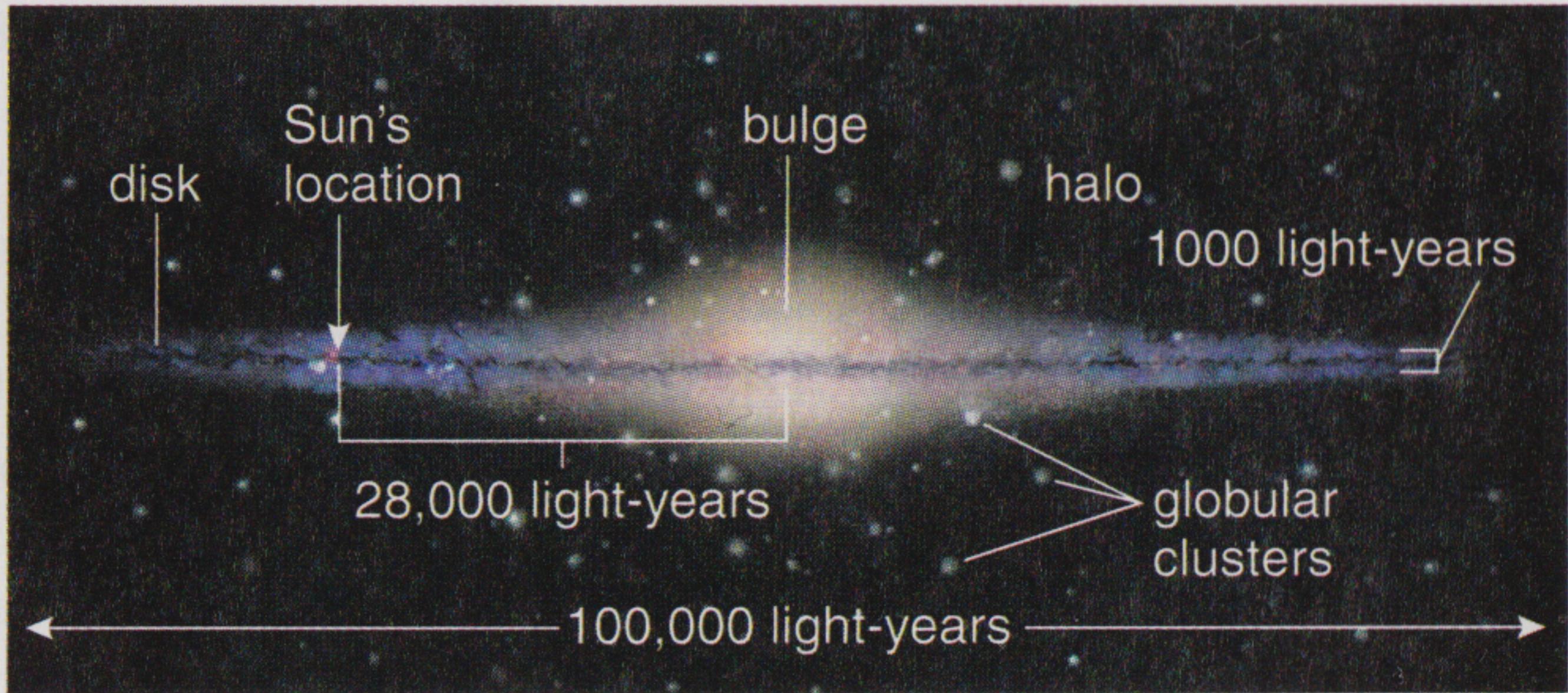
Globular clusters are distributed symmetrically around the center of the Milky Way; and since they're not in the disk, they're much less subject to dust absorption



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

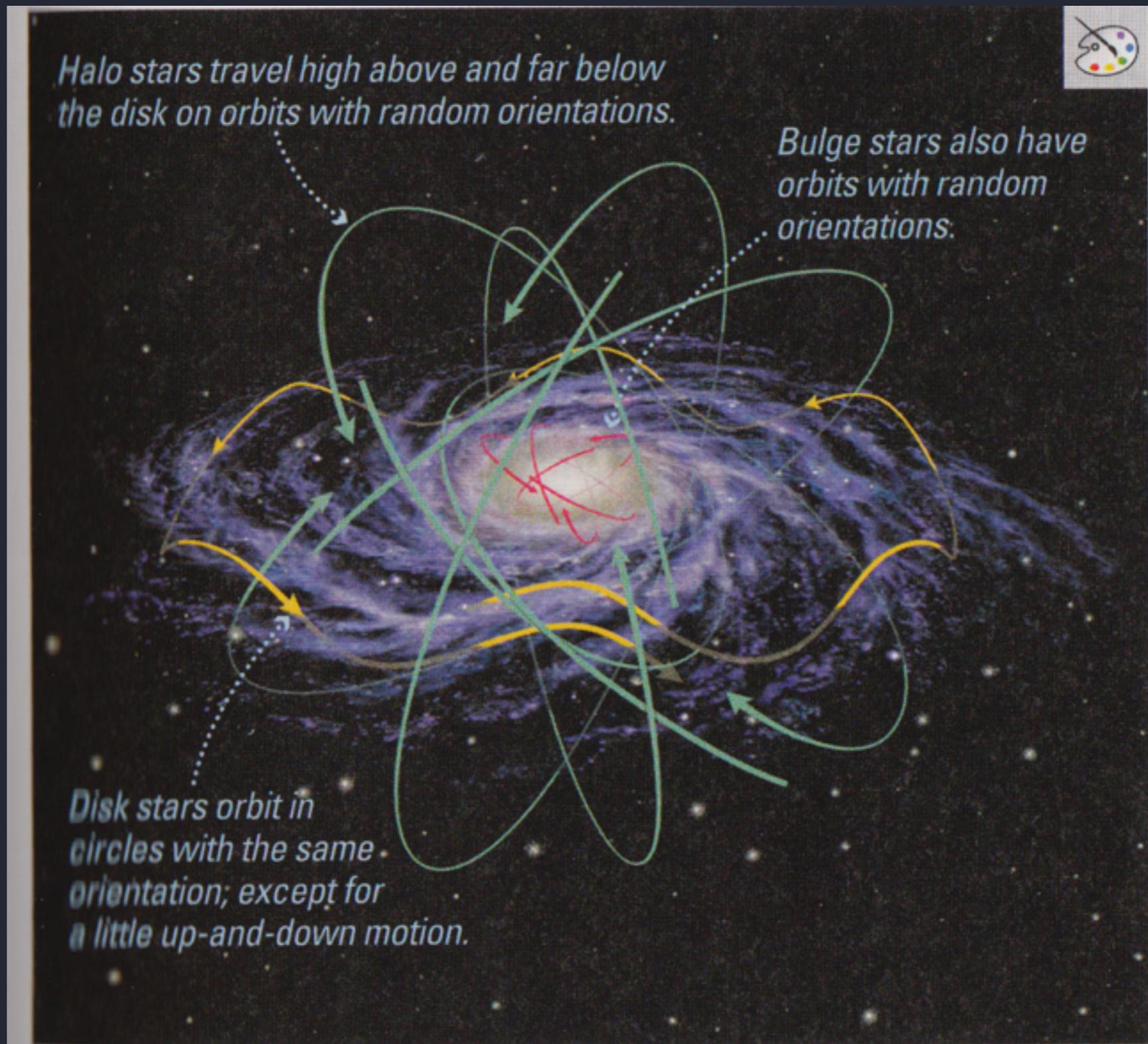


a Artist's conception of the Milky Way viewed from the outside.



**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.)