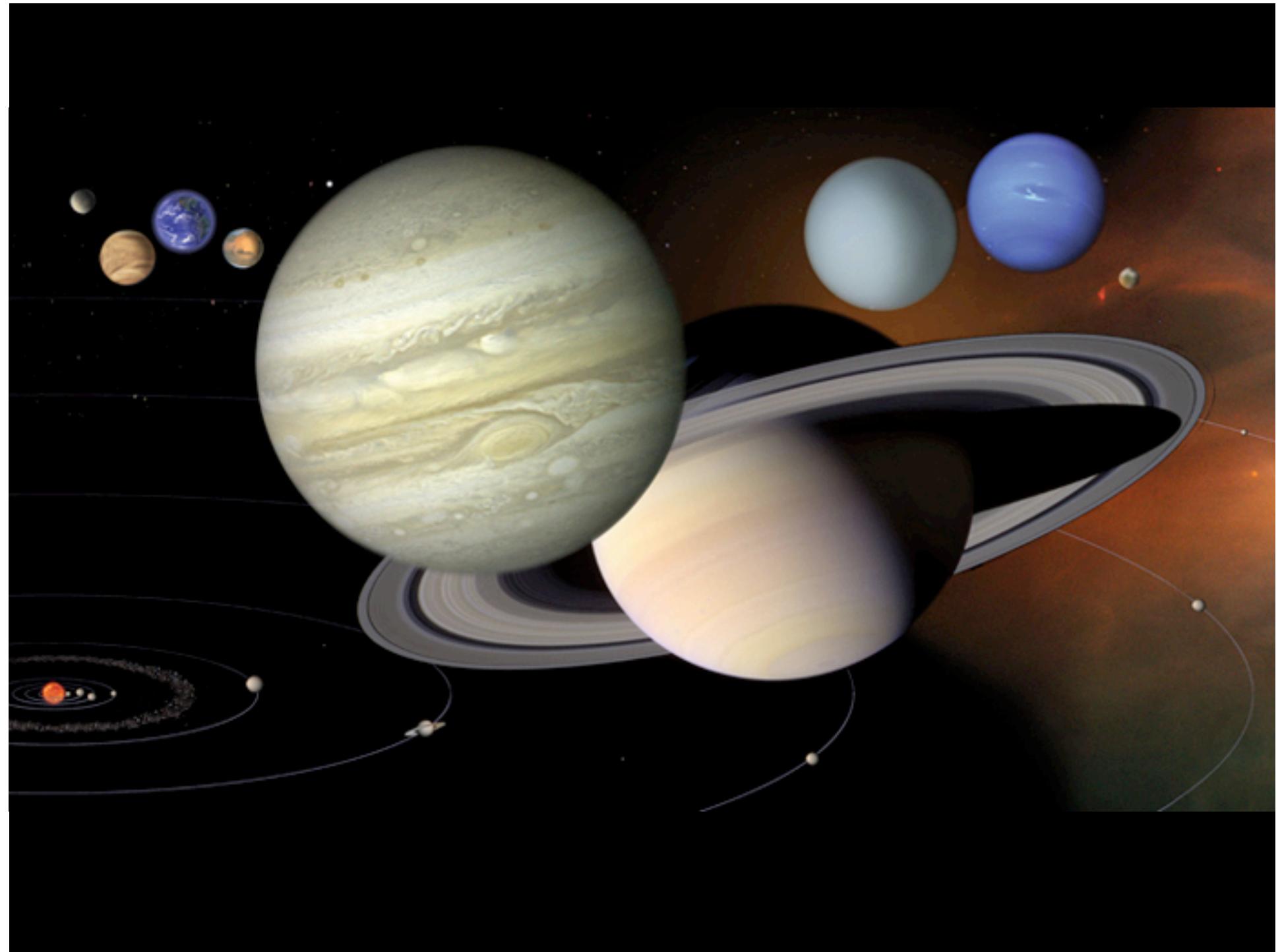


# Galaxies

Jes Ford

PhD Student at UBC







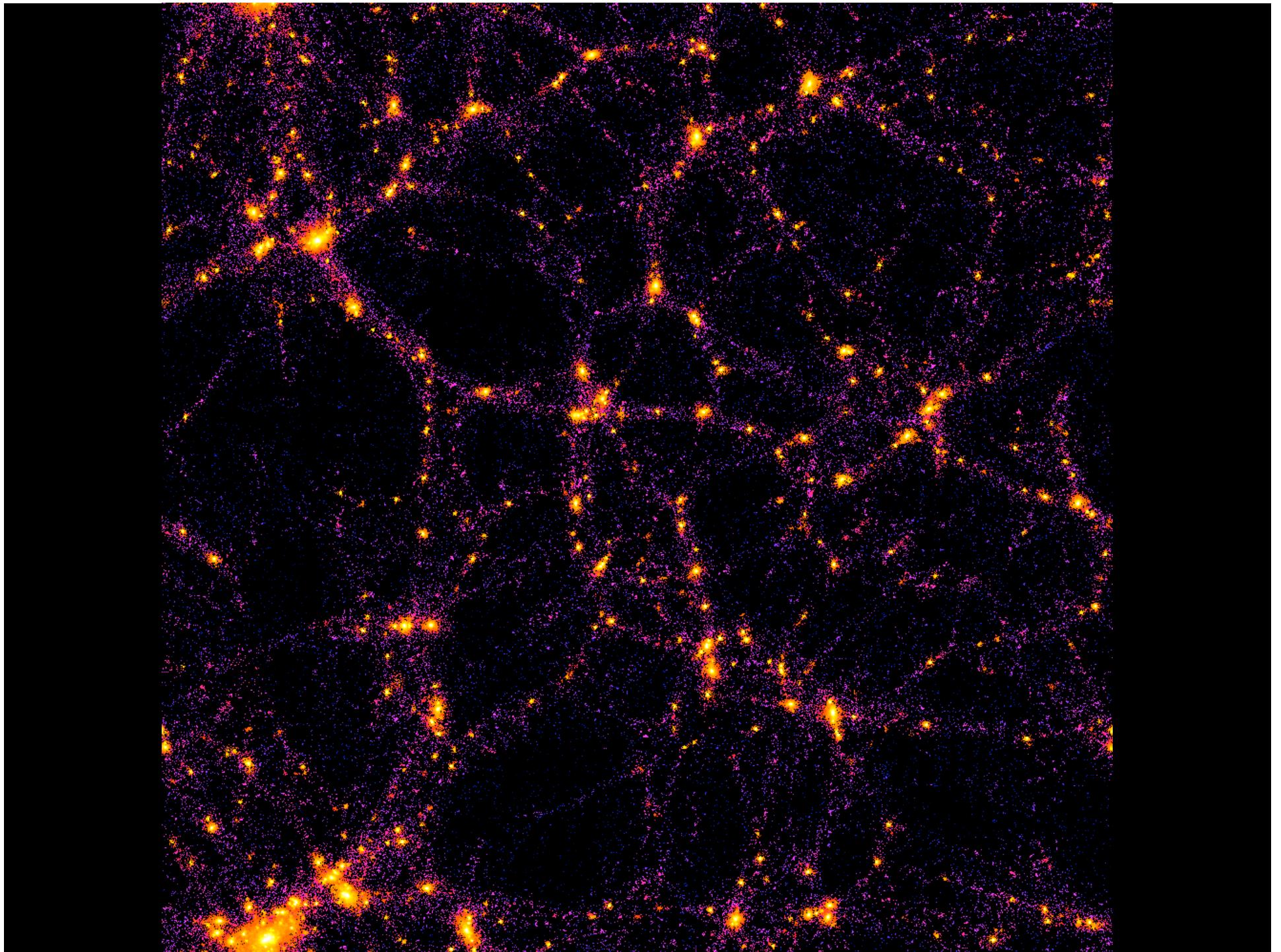
# The Night Sky



© 2008 Jerry Lodriguss / Astropix.com







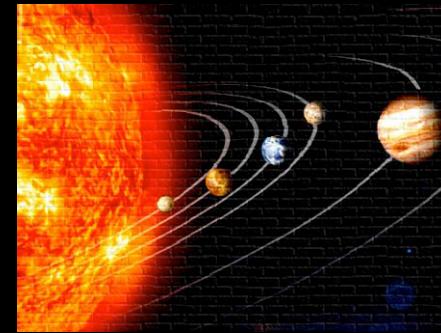
# Sizes in the Universe



$\sim 1 \text{ m}$



$\sim 10^7 \text{ m}$



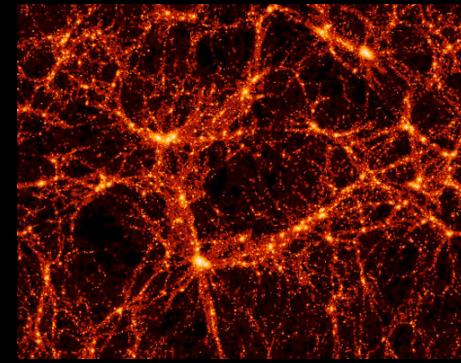
$\sim 10^{13} \text{ m}$   
 $\sim 500 \text{ light minutes}$



$\sim 10^{21} \text{ m}$   
 $\sim 100,000 \text{ light years}$



$\sim 10^{23} \text{ m}$   
 $\sim 10 \text{ million light years}$

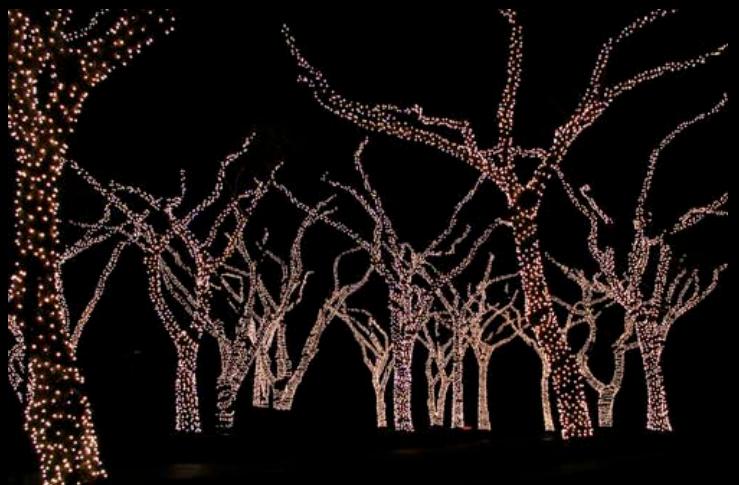


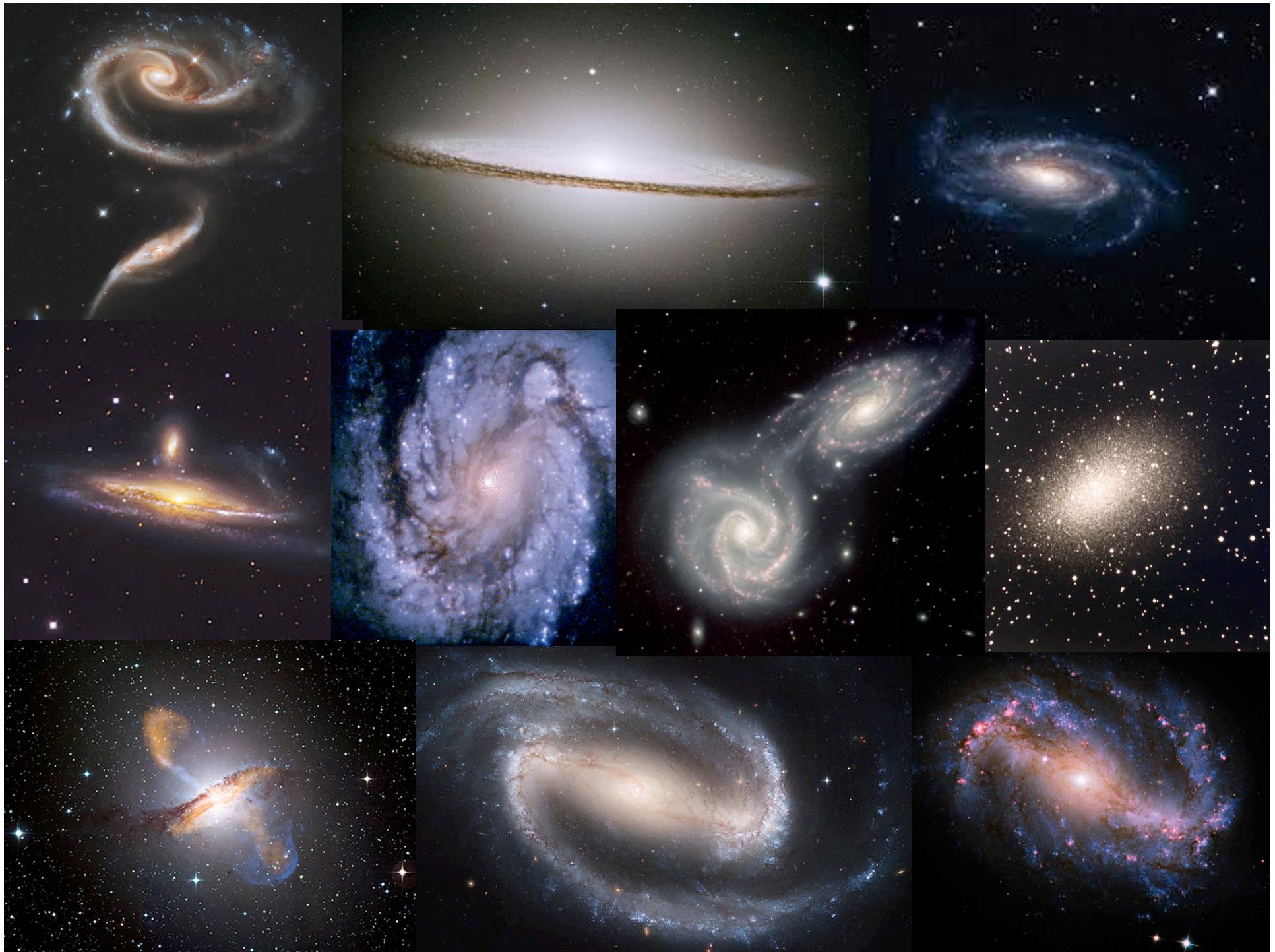
$> 10^{24} \text{ m}$   
 $> 100 \text{ million light years}$

# What makes up a Galaxy?

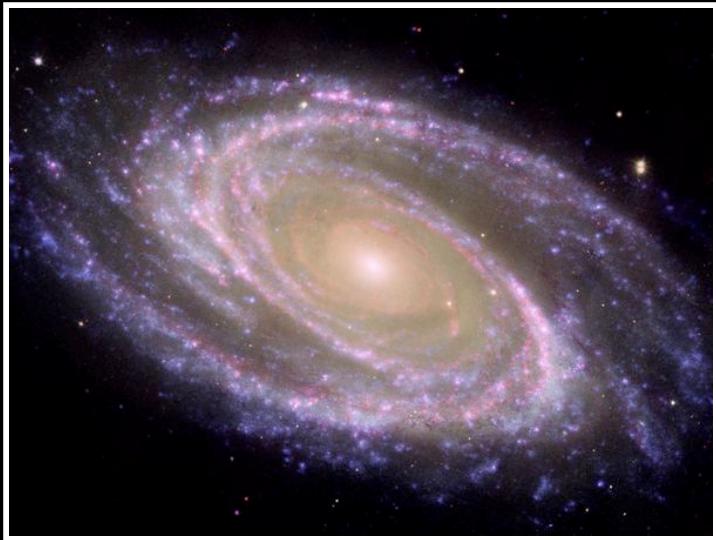
# What makes up a Galaxy?

- **Stars**  
*100 Billion per galaxy, but its a small part overall*
- **Gas and Dust**  
*More gas than stars, glows in infrared light*
- **Planets, Rocks, Asteroids**  
*a very small part of a galaxy, dark*
- **Dark Matter**  
*Invisible, but makes up MOST of the galaxy!*





# Galaxy Types



Spiral galaxies



Elliptical galaxies

# Flythrough the universe

- Sloan Digital Sky Survey (SDSS) has made a 3D map of galaxies in part of the universe.
- But there are more than 100-Billion galaxies in the observable universe!
- Way too many galaxies for astronomers to classify, and computers aren't smart enough yet... We need **CITIZEN SCIENTISTS**.

# *Today's Project:* Galaxy Zoo

[CLASSIFY](#)[SCIENCE](#)[STORY](#)[ASTRONOMERS](#)[DISCUSS](#)[PROFILE](#)

## Few have witnessed what you're about to see

Experience a privileged glimpse of the distant universe, observed by the Sloan Digital Sky Survey and Hubble Space Telescope

### Classify Galaxies

To understand how galaxies formed we need your help to classify them according to their shapes. If you're quick, you may even be the first person to see the galaxies you're asked to classify.

[Begin Classifying](#)

# Galaxy Zoo

- [www.galaxyzoo.org](http://www.galaxyzoo.org)
- Click **CLASSIFY** to start
- Click **INVERT** to swap colours back and forth
- Click **FAVOURITE** to save a galaxy
- Click **PROFILE > FAVOURITES** to view
- Click **CLASSIFY** to go back to more galaxies
- Click **SCIENCE** if you want to learn more

## SHAPE

Is the galaxy simply smooth and rounded, with no sign of a disk?



Smooth



Features or disk

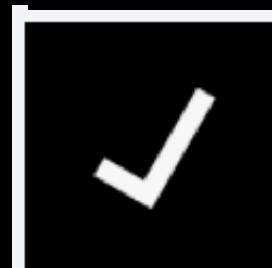


Star or artifact

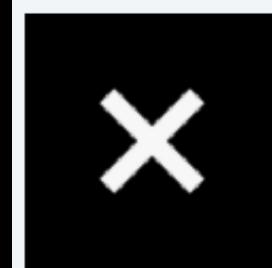


## DISK

Could this be a disk viewed edge-on?



Yes



No



# *Other Citizen Scientist Projects on:*

# The Zooniverse

galaxyzoo.org  
How do galaxies form?  
View details

Take part in Science Projects   Experiment in Laboratory

All Space Climate Humanities Nature Biology

## Space

Sort by Category

 How do galaxies form? NASA's Hubble Space Telescope archive provides hundreds of thousands of galaxy images. GALAXY ZOO	 Explore the surface of the Moon We hope to study the lunar surface in unprecedented detail. MOON ZOO	 Study explosions on the Sun Explore interactive diagrams to learn about the Sun and the spacecraft monitoring it. SOLAR STORMWATCH	 Find planets around stars Lightcurve changes from the Kepler spacecraft can indicate transiting planets. planethunters.org
 How do stars form? We're asking you to help us.	 Explore the Red Planet Planetary scientists need	 Help us find gravitational lenses	

Climate   Humanities

Model Earth's climate using historic ship logs  
Help scientists recover Arctic and worldwide weather observations made by US Navy and Coast Guard ships.  
Weather

Classify over 30 years of tropical cyclone data.  
Scientists at NOAA's National Climatic Data Center need your help.  
CycloneCenter

Study the lives of ancient Greeks  
The data gathered by Ancient Lives helps scholars study the Oxyrhynchus collection.  
ANCIENT LIVES

Nature

Hear Whales communicate  
You can help marine researchers understand what whales are saying.  
WHALE

Help explore the ocean floor  
The HabCam team and the Woods Hole Oceanographic Institution need your help.  
SEAFLOOR EXPLORER

You're hot on the trail of bats!  
Help scientists characterise bat calls recorded by citizen scientists.  
BAT DETECTIVE

Go wild in the Serengeti!  
We need your help to classify all the different animals caught in millions of camera trap images.  
SNAPSHOT SERENGETI

Biology

Analyse real life cancer data.  
You can help scientists from the world's largest cancer research institution find cures for cancer.  
Cell Slider

Track genetic mysteries  
We can better understand how our genes work by spotting the worms laying eggs.  
WORM WATCH LAB

[www.zooniverse.org](http://www.zooniverse.org)

# Galaxy Art

- Create your own galaxy artwork to take home.
- Use your favourite real galaxy from Galaxy Zoo or your imagination.
- What type of galaxy do you want to create?

