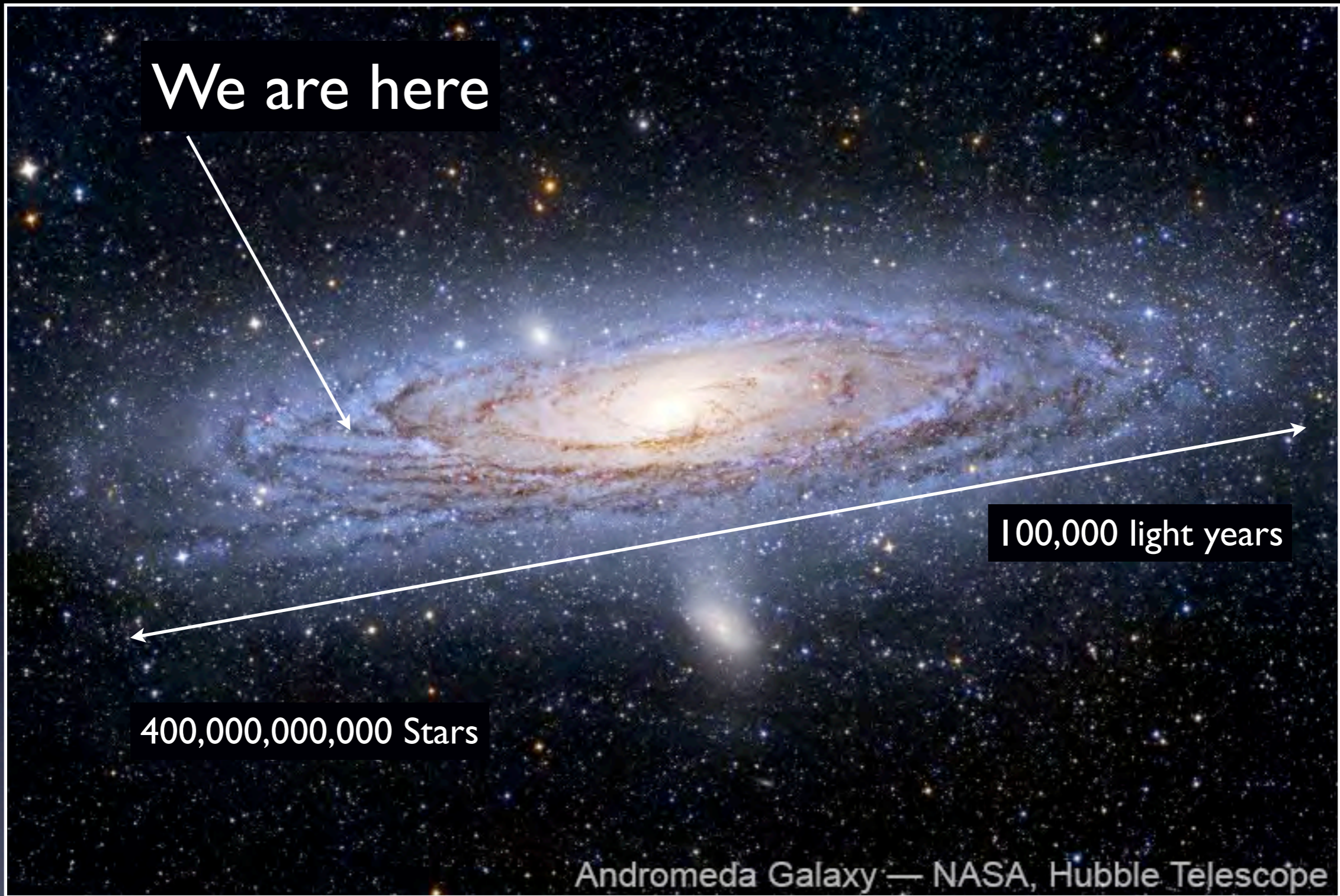


The Secret Lives of Galaxies

Prof Geraint F. Lewis

CAASTRO in the Classroom



What is a galaxy?

10,000,000,000,000 stars

60,000,000 light years

Giant Elliptical Galaxy

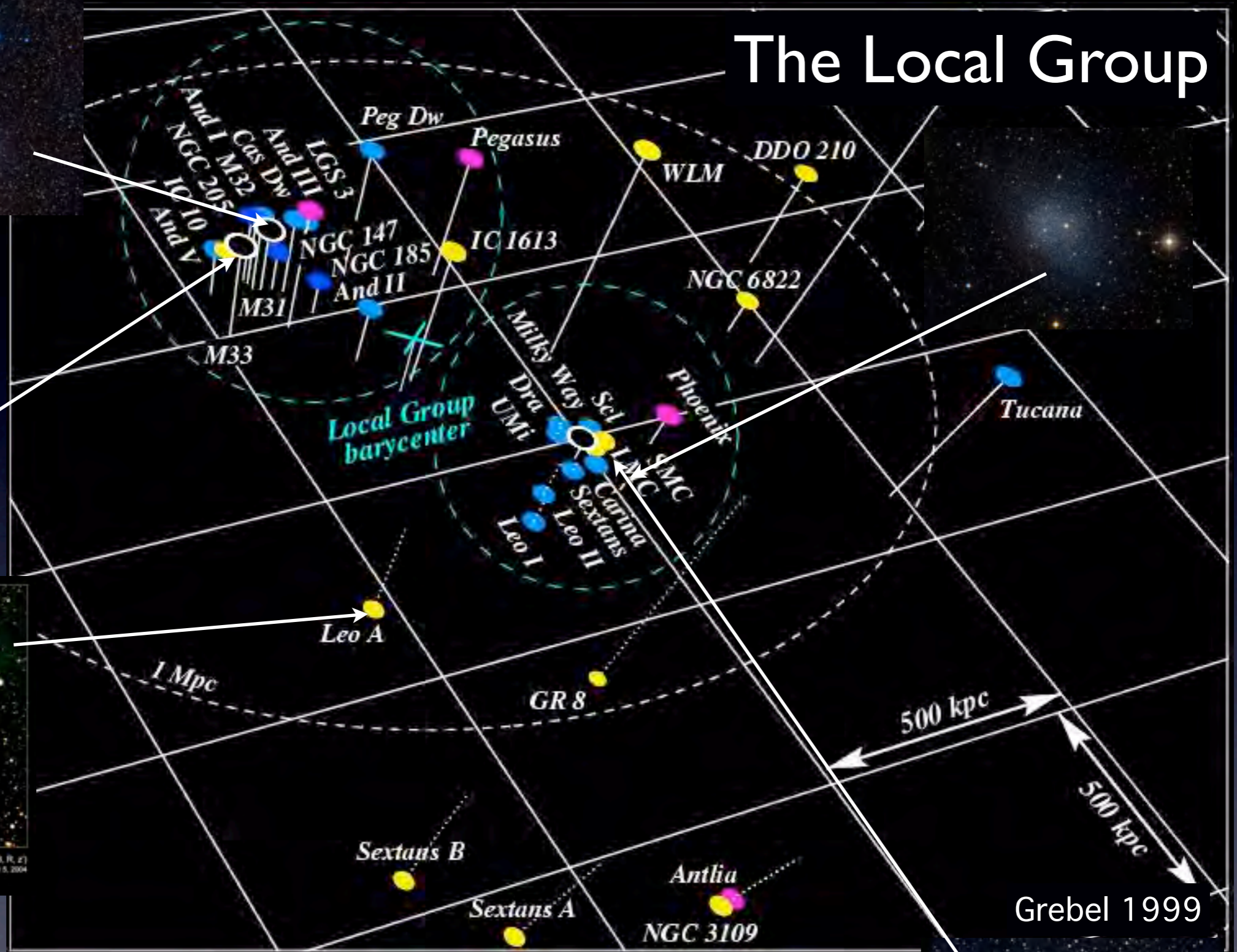
Dwarf Galaxy

1,000,000 stars

2,000 light years

More than one kind of galaxy

The Local Group



Where do galaxies live?



A Giant Cluster of Galaxies



Galaxy Cluster Abell 2218

HST • WFPC2

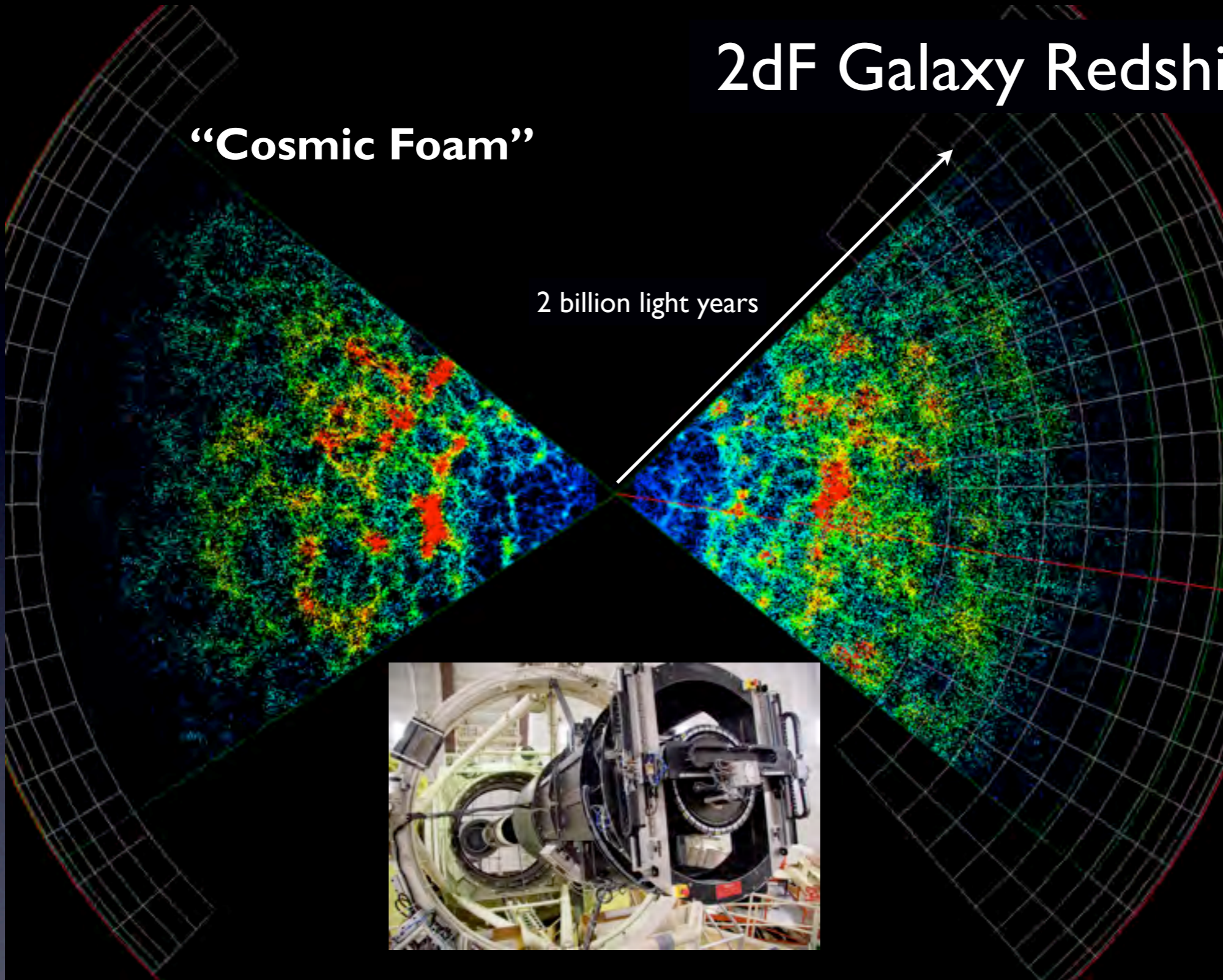
NASA, A. Fruchter and the ERO Team (STScI, ST-ECF) • STScI-PRC00-08

Where do galaxies live?

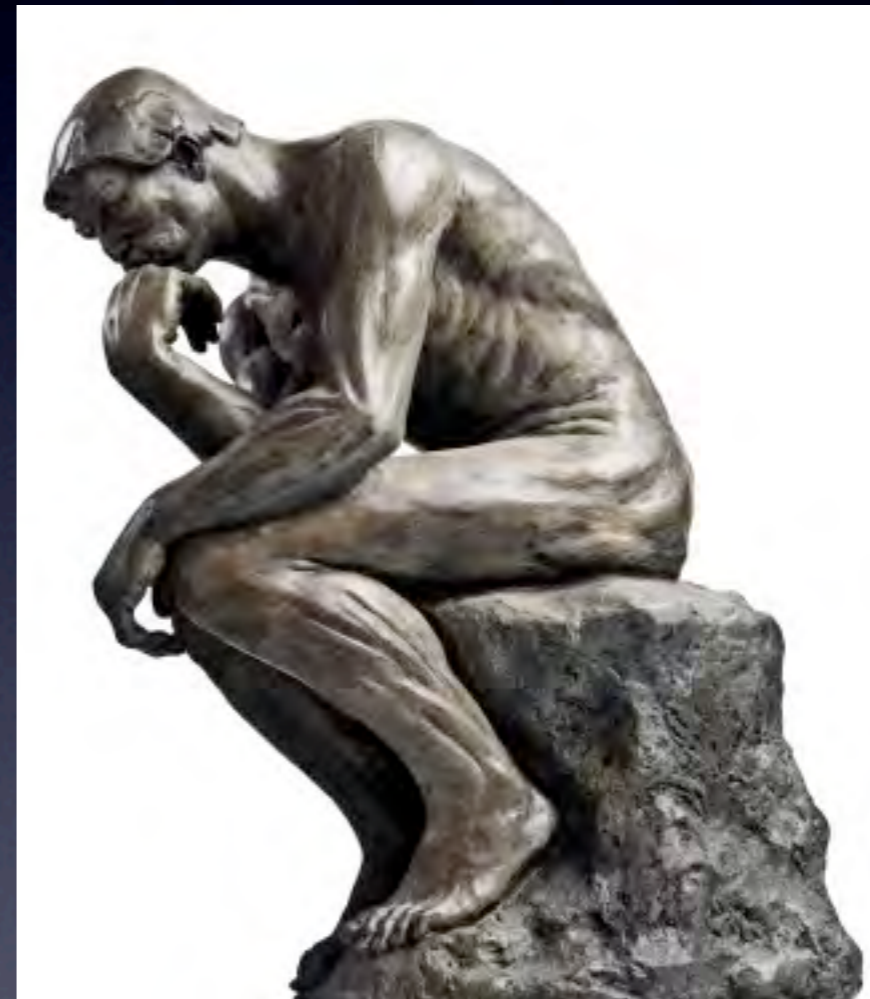
2dF Galaxy Redshift Survey

“Cosmic Foam”

2 billion light years



Where do galaxies live?



Where does it all come from?


CIRCULAR ORBITS

$$F_c = \frac{mv^2}{r} = \frac{GMm}{r^2} = F_g$$

$$v^2 = \frac{GM}{r} = \left(\frac{2\pi r}{P}\right)^2$$

$$P^2 = \left[\frac{4\pi^2}{G}\right] \frac{a^3}{M_{\text{orbiter}}}$$

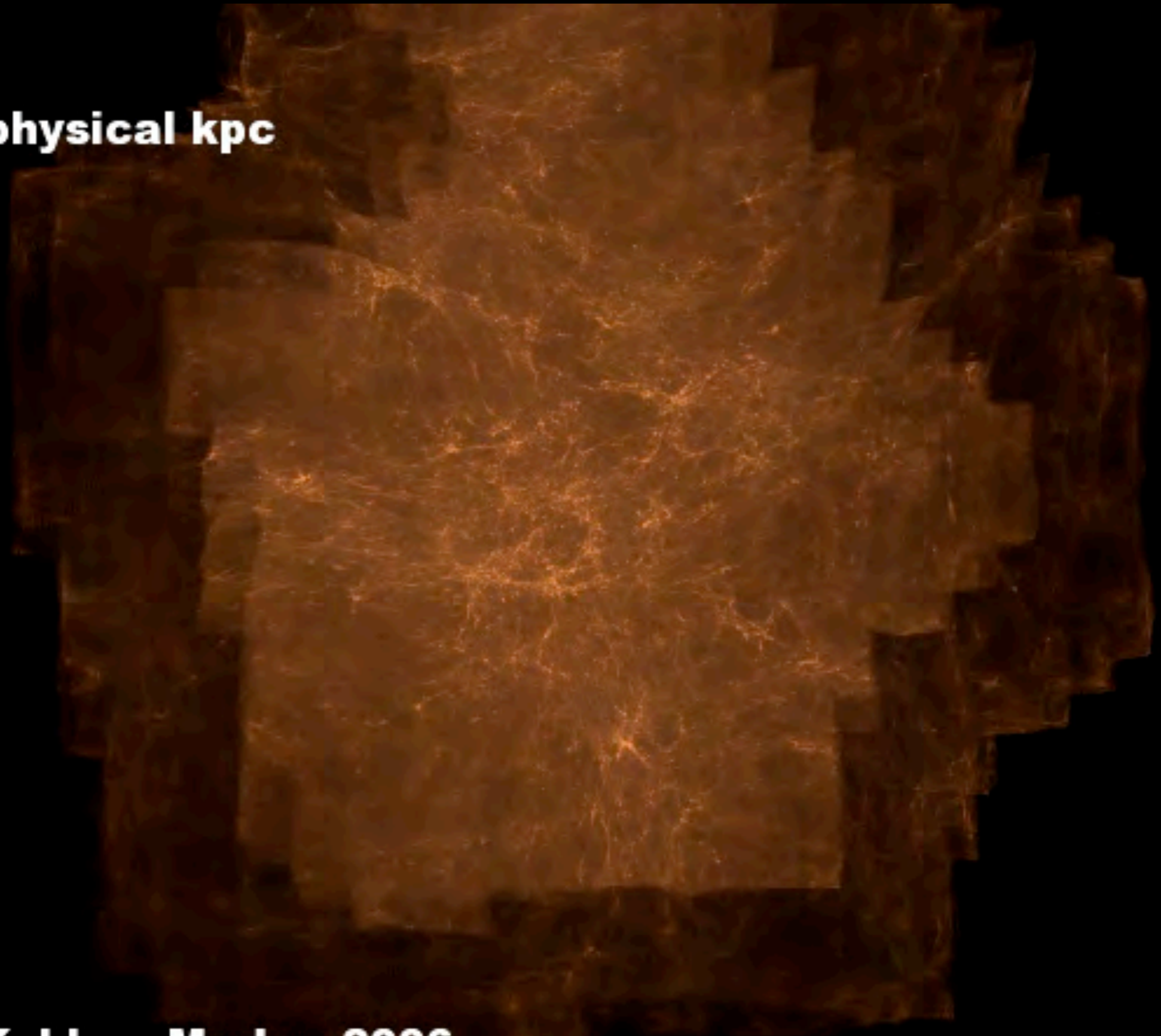
NVK3L = Weigh the Universe!
More Exactly

$$P^2 = \frac{4\pi^2}{G} \frac{a^3}{(M+m)}$$



The Super-Computer Solution!

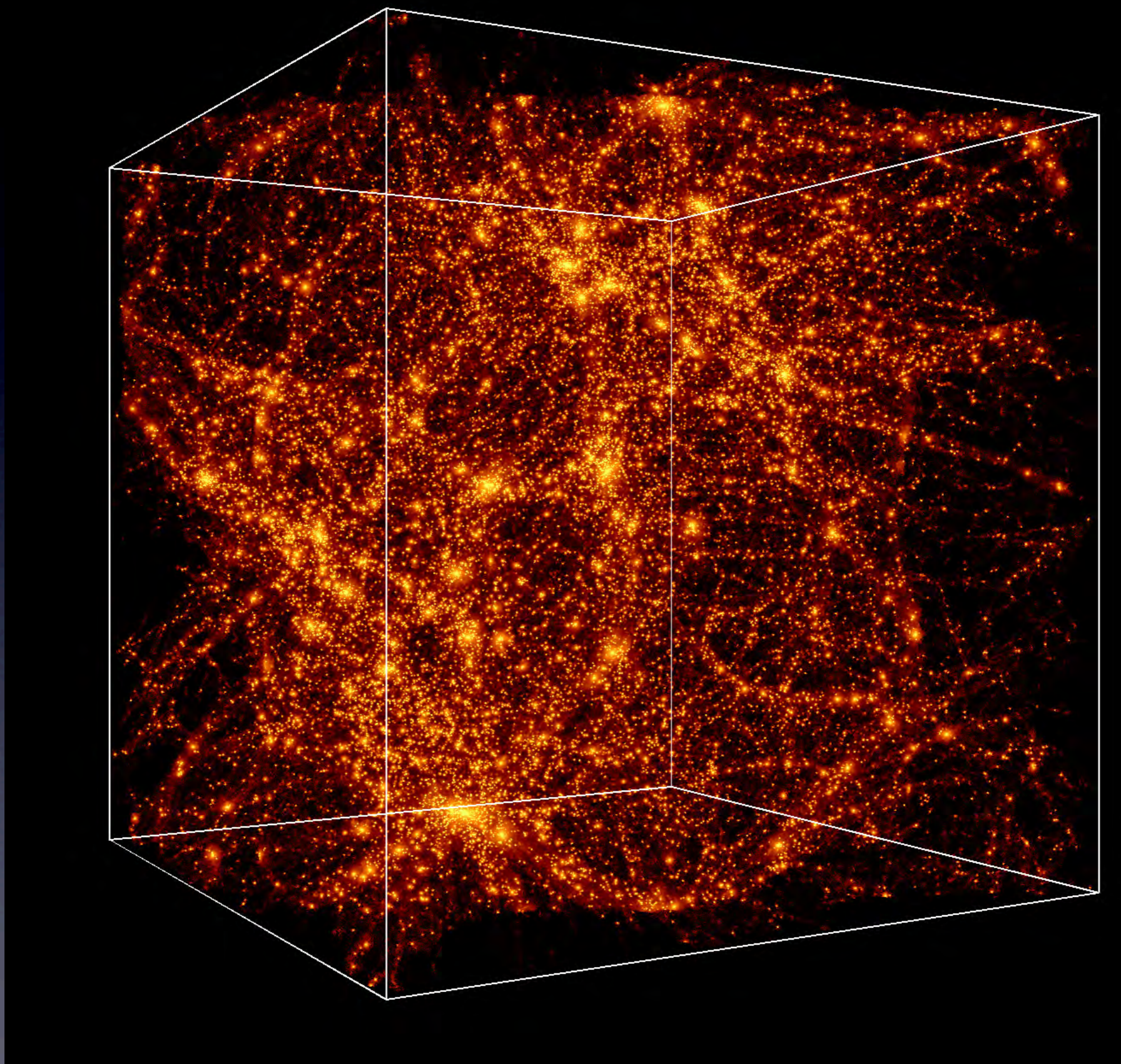
$z=11.9$

800 x 600 physical kpc



Diemand, Kuhlen, Madau 2006

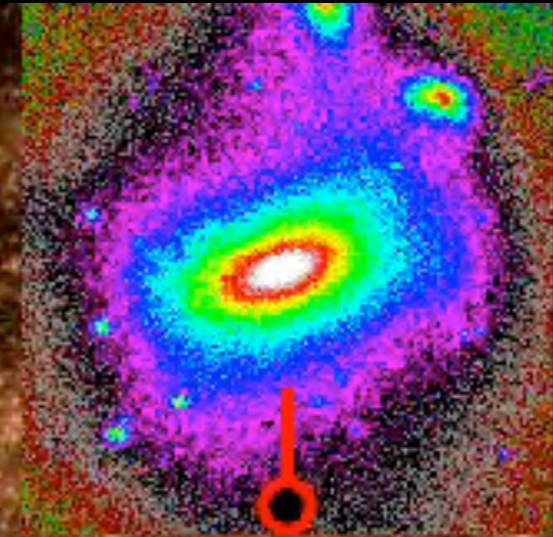
The Universe in a Computer



The Universe in a Computer

$z=2.0$

800 x 600 physical kpc



$M_t = 1.6e+10 M_\odot$

Diemand, Kuhlen, Madau 2006

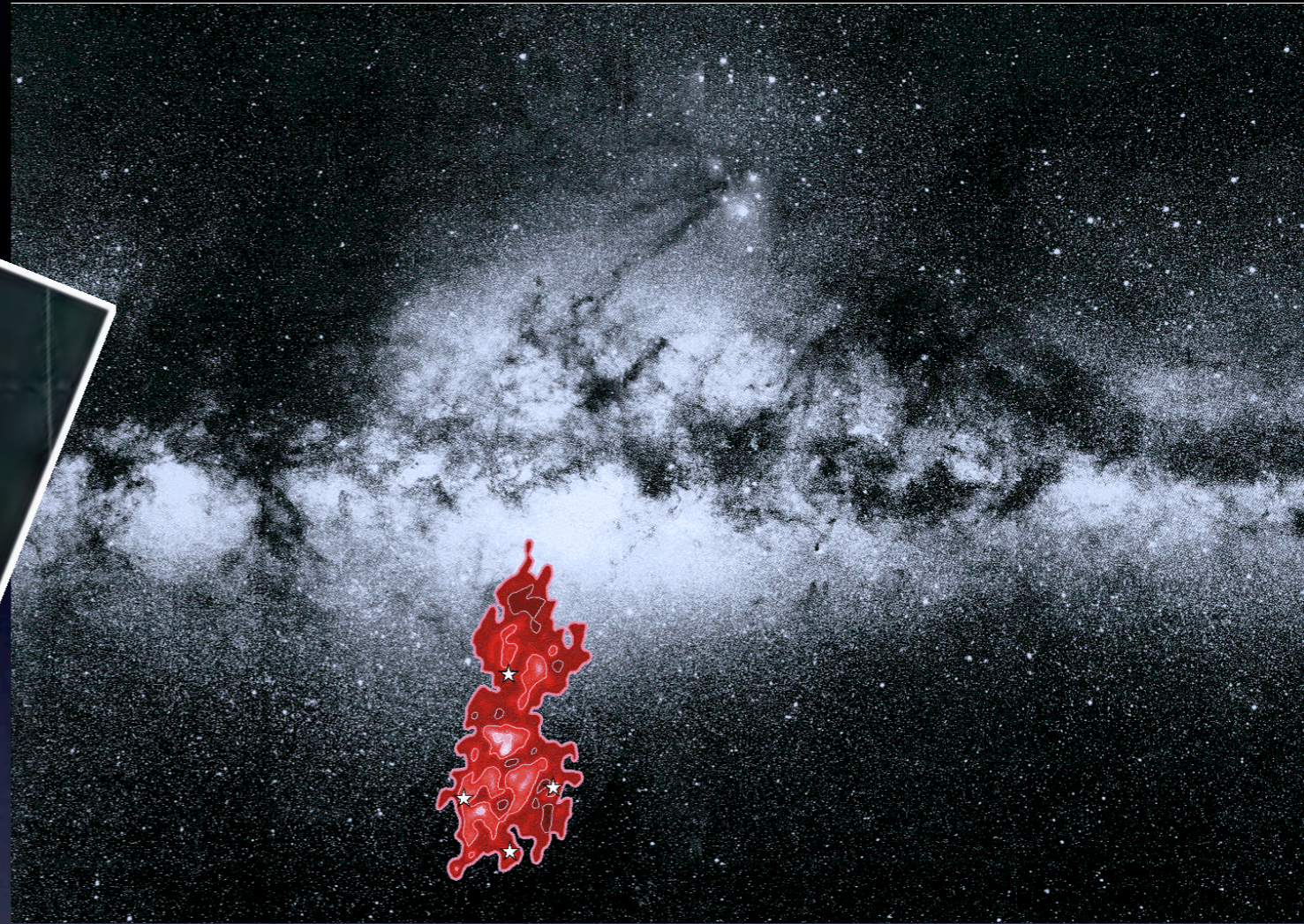
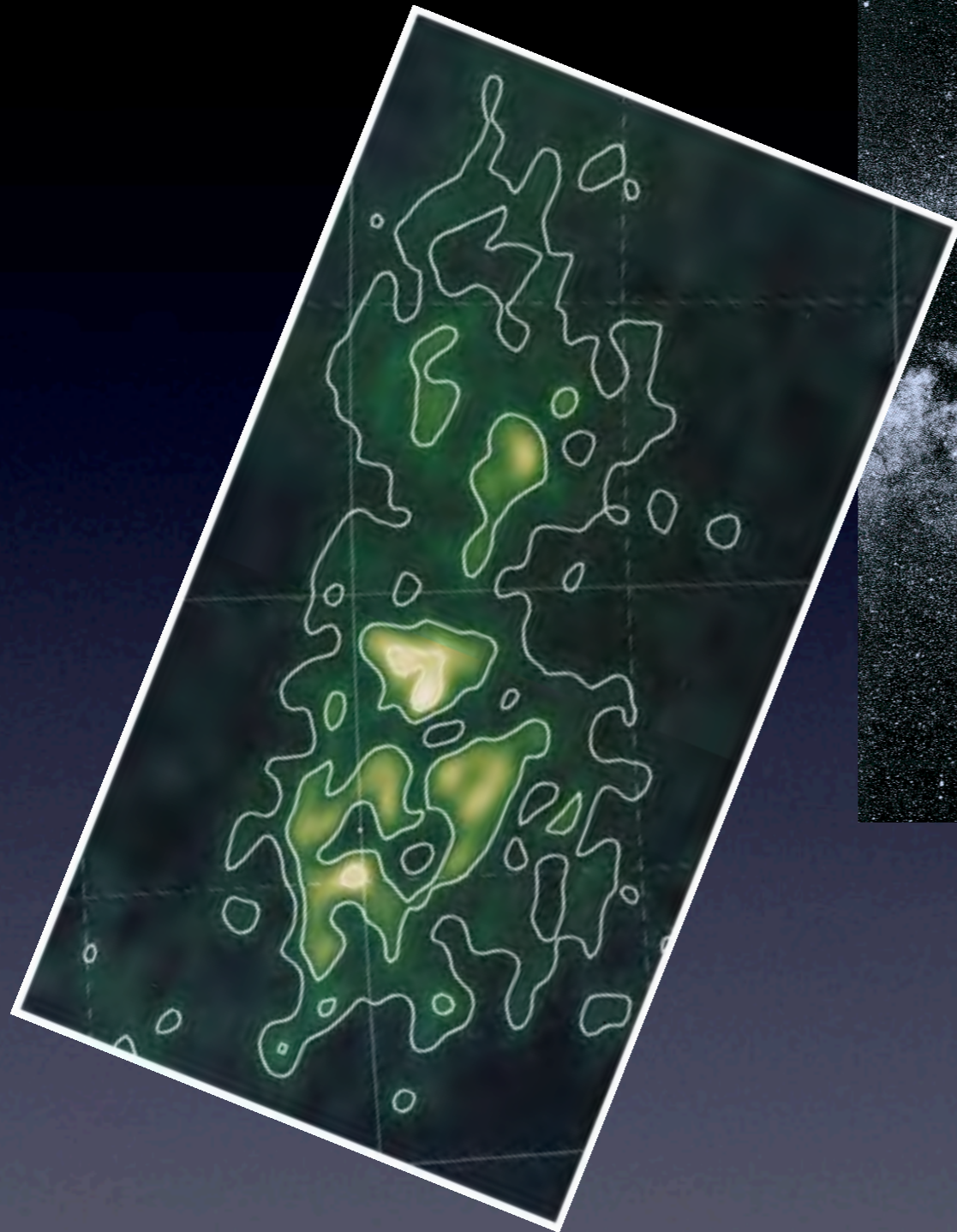
The Formation of the Galaxy

Where is all the debris?



Galactic Cannibalism?

The Sagittarius Dwarf Galaxy



Discovered by graduate student, Rodrigo Ibata, in 1994.

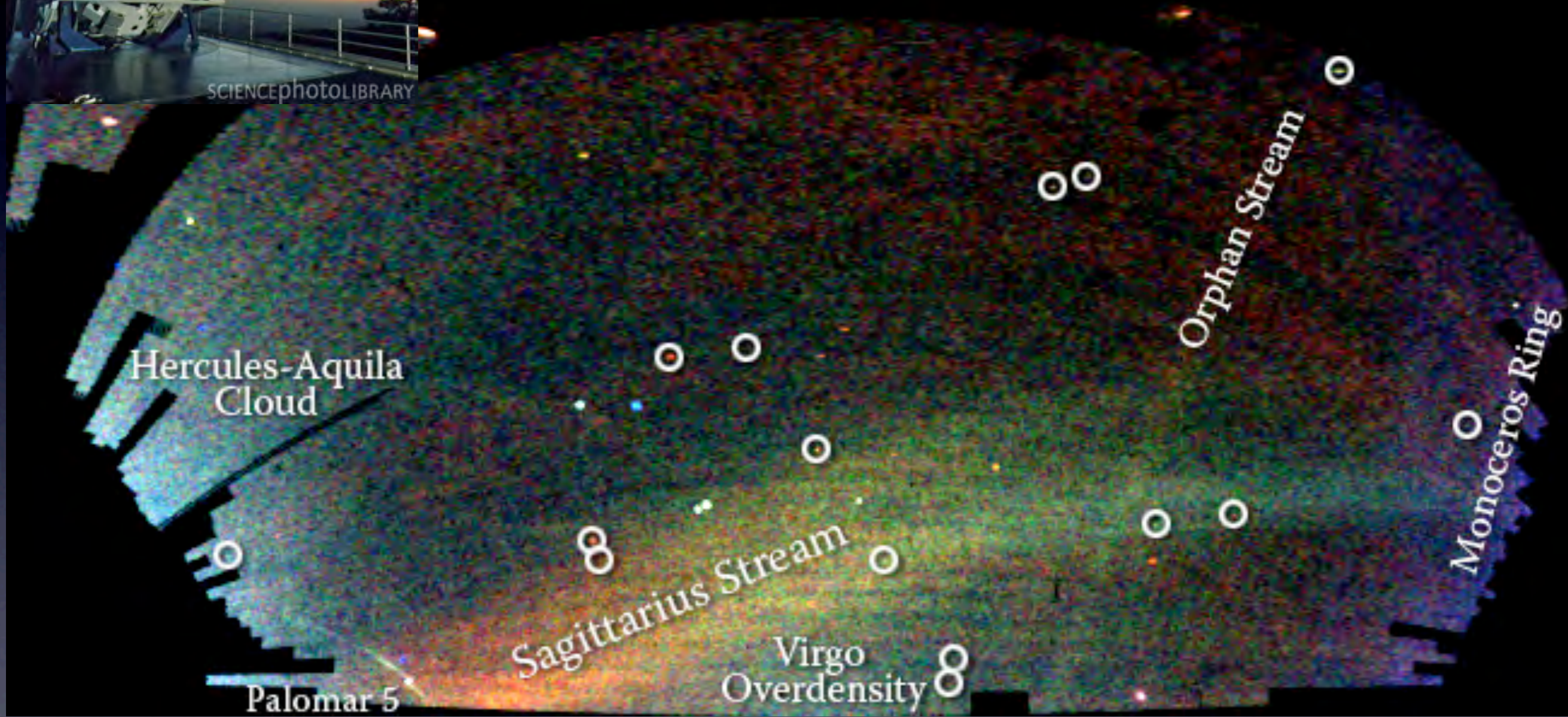
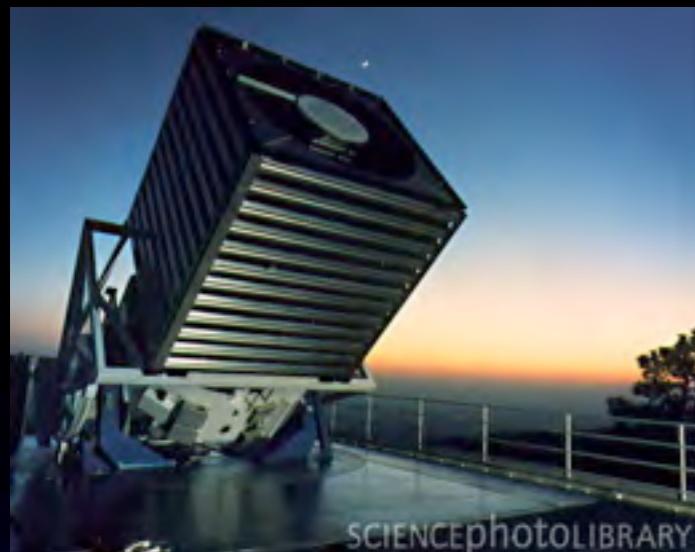
A ghost in Sagittarius

The Sagittarius Dwarf Galaxy



A ghost in the Sky

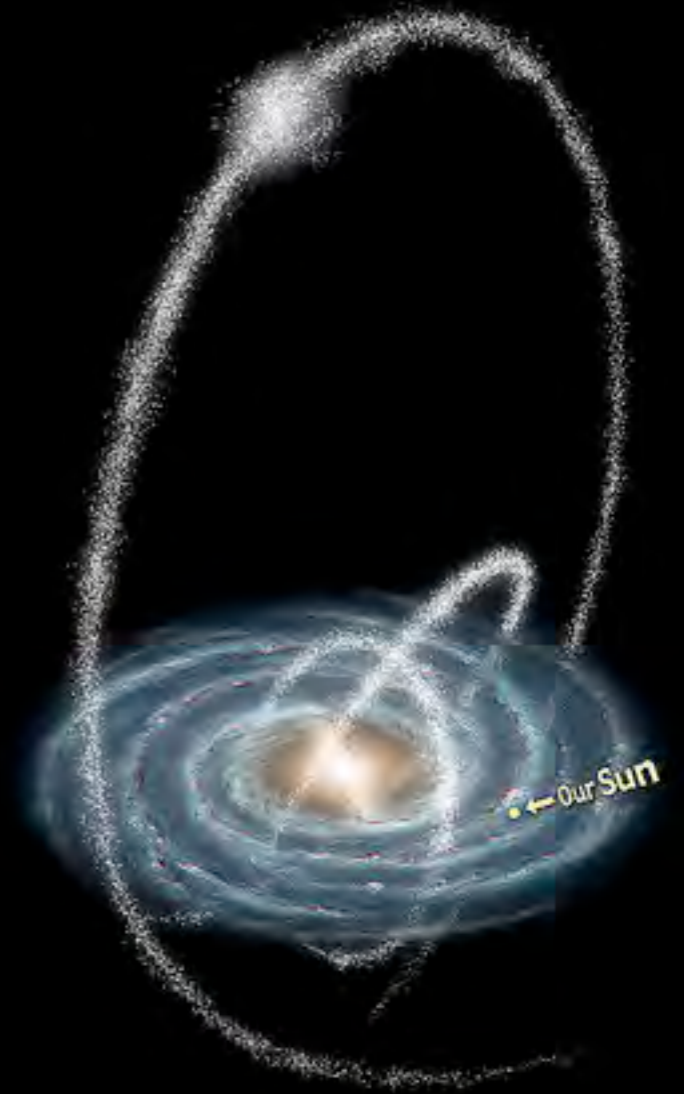
Sloan Digital Sky Survey



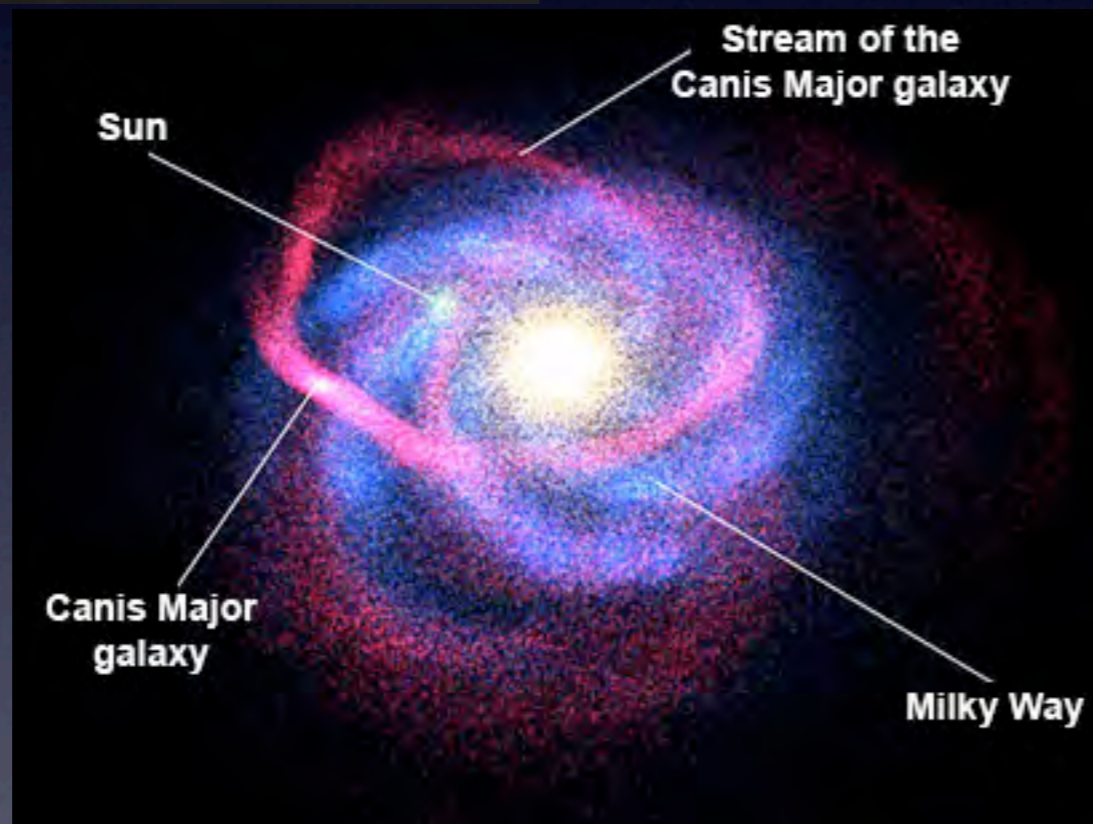
The Field of Streams

Vasily Belokurov & SDSS

Pal5 Stream



The Virgo Overdensity



The Galaxy is still a Cannibal!

Pan-Andromeda Archaeological Survey (PAndAS)



Canada France Hawaii Telescope



Size of the Full Moon

It's not just the Milky Way



John Dubinski

In 3-4 Billion Years.....



Colliding Galaxies NGC 4038 and NGC 4039

HST • WFPC2

PRC97-34a • ST ScI OPO • October 21, 1997 • B, Whitmore (ST ScI) and NASA

Our Sparkly Future



John Dubinski

In 3-4 Billion Years.....

The view of the sky during the collision between the MW and M31



NASA, ESA, Z. Levay and R. van der Marel (STScI), and A. Mellinger

The End