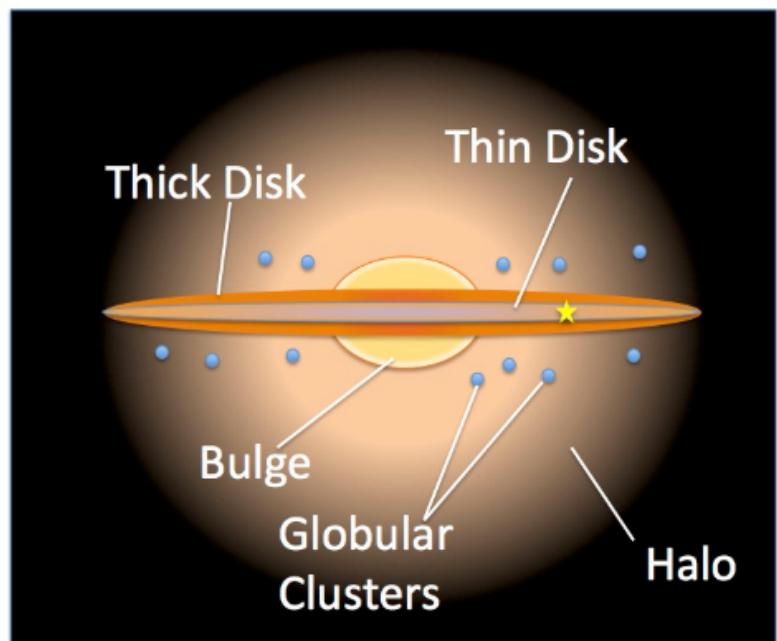


OBSERVATIONAL APPROACHES TO GALAXY FORMATION

- GALACTIC ARCHAEOLOGY
 - *INFERRING FORMATION HISTORY ON AN OBJECT-BY-OBJECT BASIS*
- “EXPERIMENTS”
 - *STUDY OF CONTROLLED SAMPLES WHERE YOU TRY TO ISOLATE EFFECTS OF ONE QUANTITY ON ANOTHER*
- SYSTEMATIC CENSUS OF THE POPULATIONS AND THEIR EVOLUTION (SURVEYS)
 - *WATCH POPULATION CHANGE*

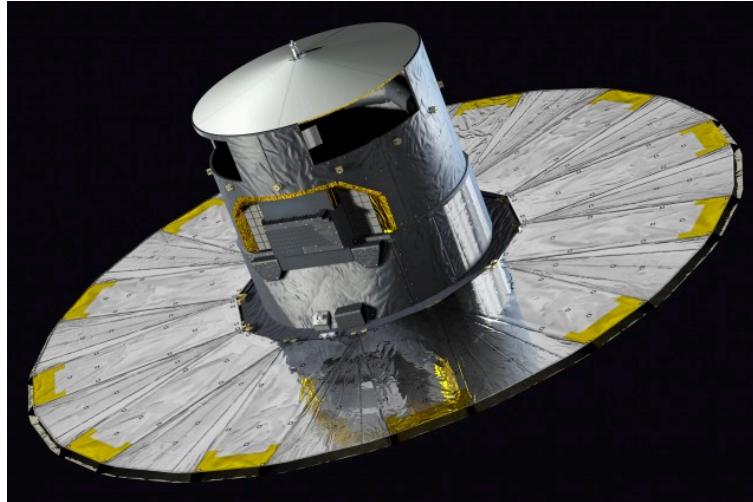
GALACTIC ARCHEOLOGY

Galactic archeology aims to study the structure and evolution of our galaxy by measuring ages and chemical compositions of stellar populations in different parts of the Milky Way



The Milky Way is an ideal testbed for galaxy formation theory, because we can study in detail the properties and motions of the stars in its four stellar components: a bulge (the very center), two separate disks of stars stacked inside one another like Russian Dolls, and the stellar halo.

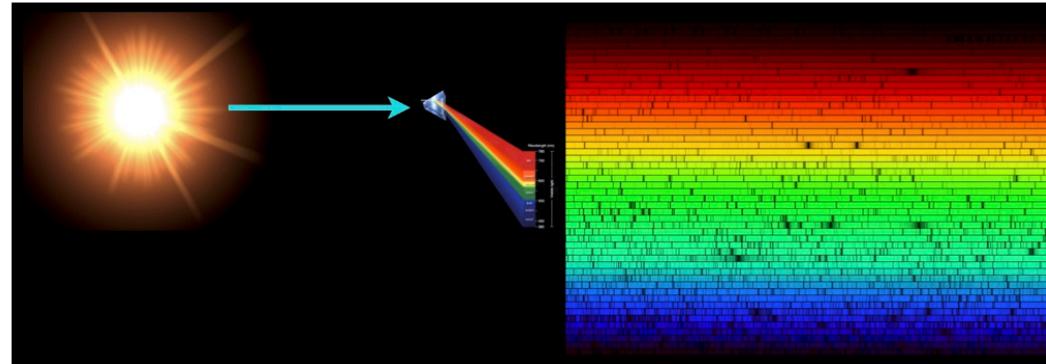
THE GAIA SURVEY



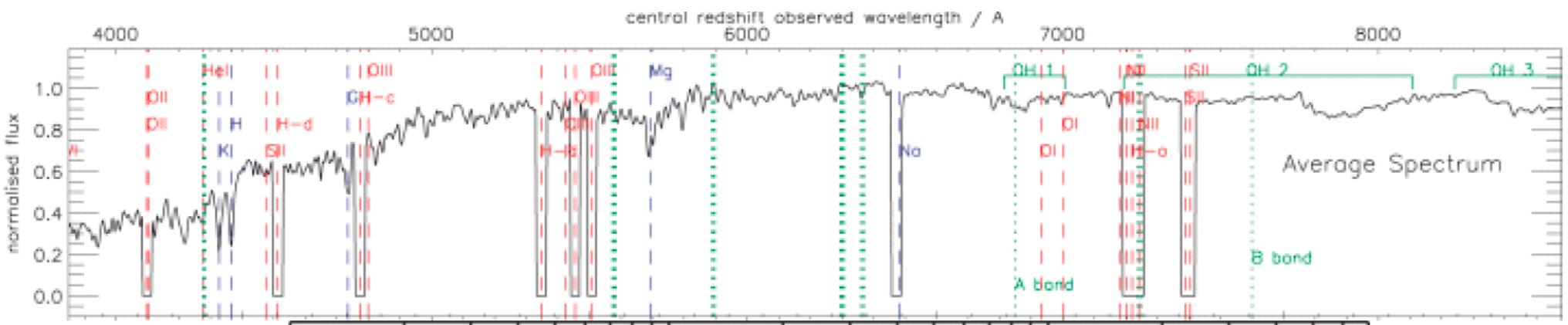
Gaia is providing unprecedented positional and radial velocity measurements with the accuracies needed to produce a stereoscopic and kinematic census of about one billion stars in our Galaxy and throughout the Local Group. This amounts to about 1 per cent of the Galactic stellar population

<https://www.youtube.com/watch?v=bZfFdCknTQc&feature=youtu.be>

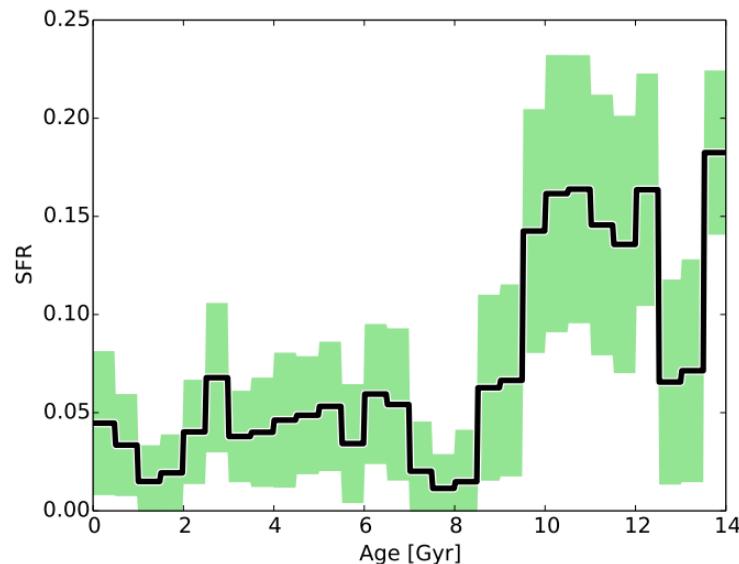
CHEMICAL COMPOSITION AND AGE OF STARS AS COSMIC TRACER



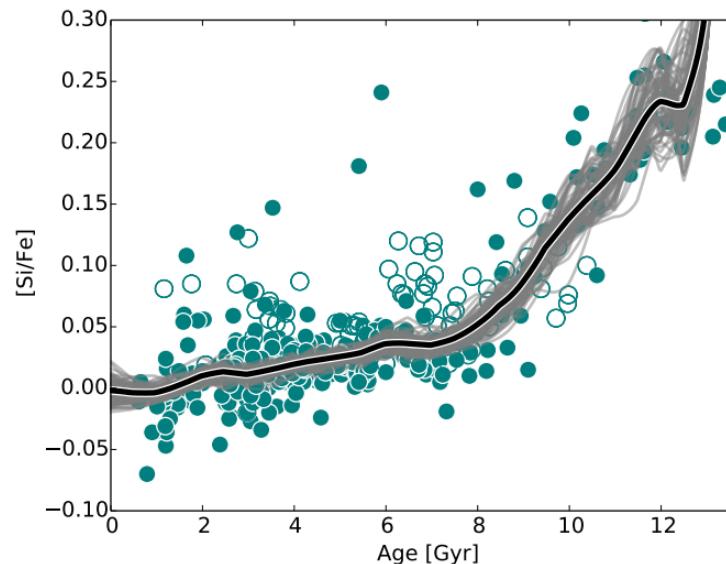
Stellar spectroscopy defines the methods used to extract the number and amount of the elements present in a star's atmosphere. The hot interior of a star sends out high-energy photons, which excite the atoms of the elements as they pass through the cooler outer atmosphere of the star. The atoms absorb some of the energy from these photons, which can be observed as an absorption feature in a star's spectrum.



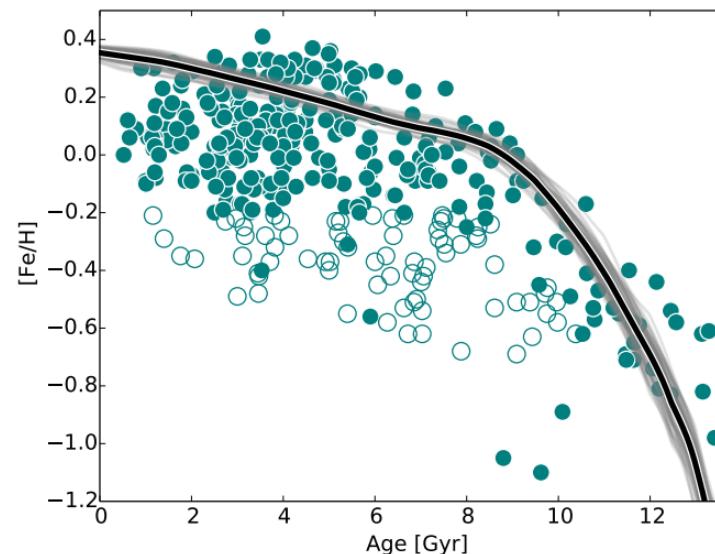
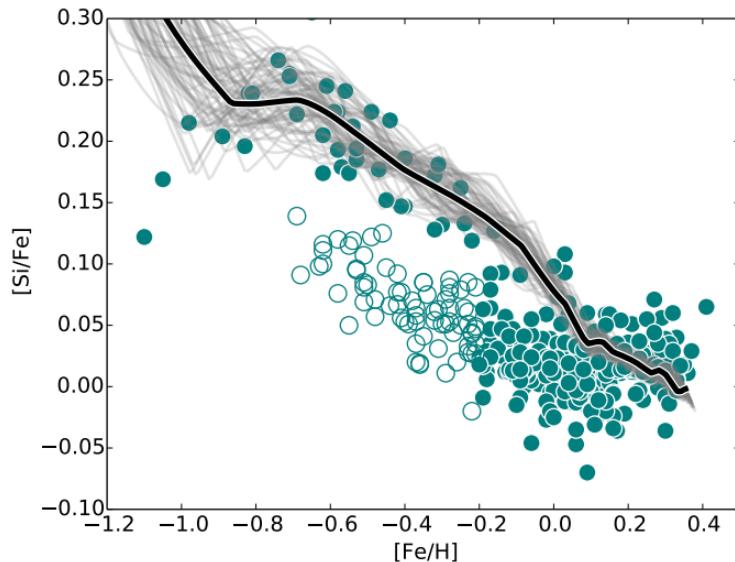
MILKY WAY STAR FORMATION HISTORY



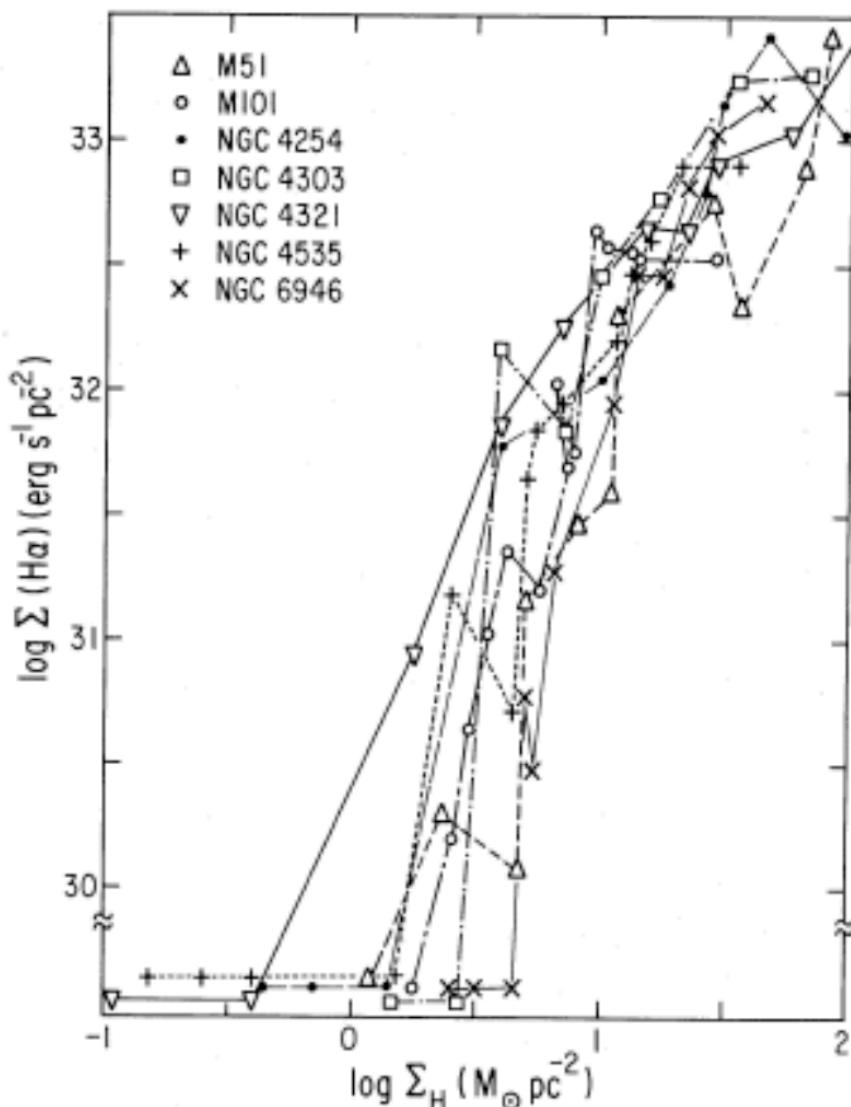
(a)



(b)



“EXPERIMENTS”



**DIRECT ACCESS
TO PHYSICS....**

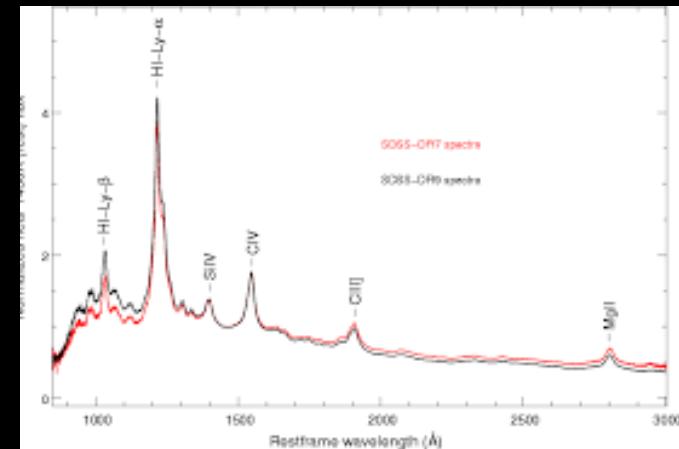
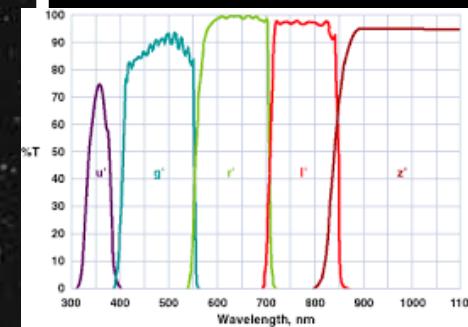
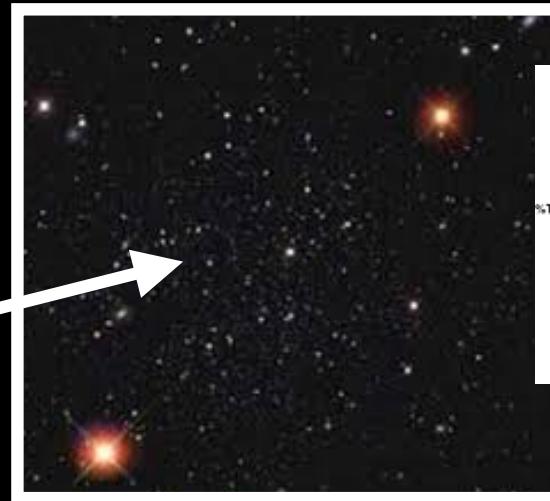
**SFR SURFACE DENSITY
AS A FUNCTION
OF GAS SURFACE DENSITY**

KENNICUT 1989

FIG. 8.—Dependence of H α surface brightness on total ($\text{H I} + \text{H}_2$) hydrogen surface density, for seven giant Sc galaxies. Each point represents the H α and gas densities averaged at a given galactocentric radius, and lines connect points at adjacent radii. The points at the bottom denote regions where no H α emission was detected.

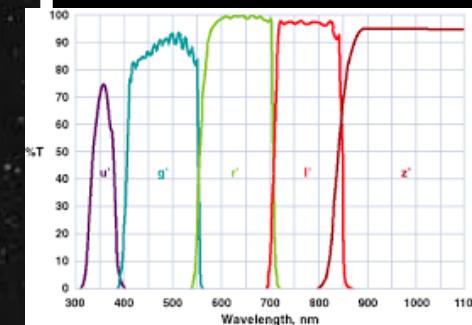
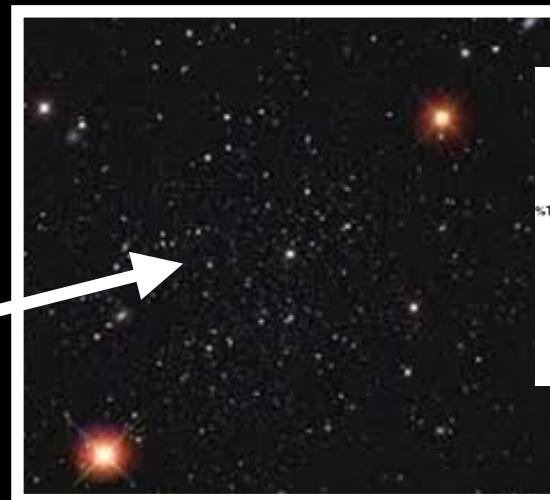
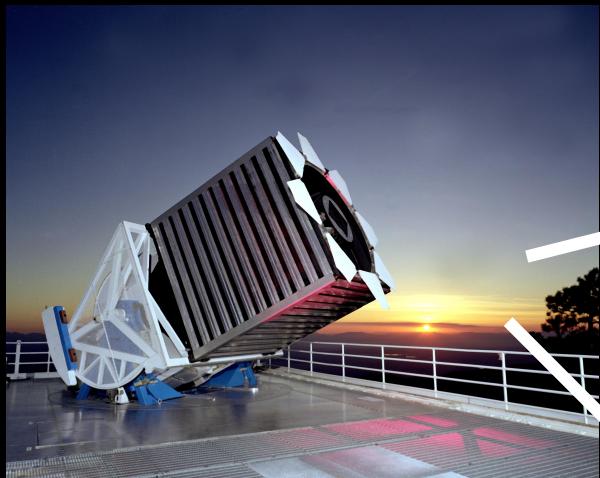
SURVEYS

PHOTOMETRY [IMAGES]

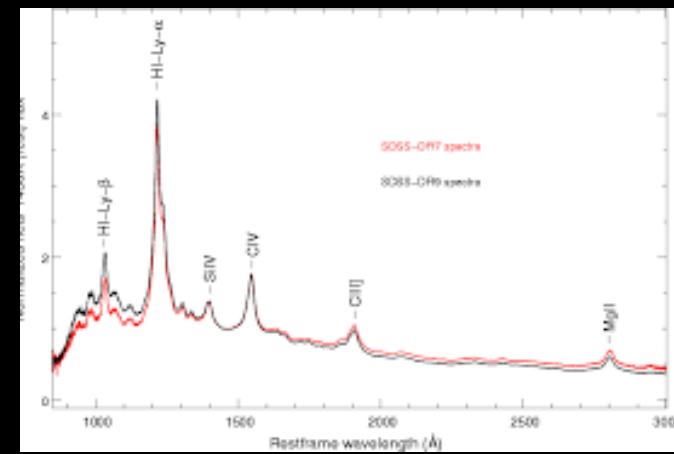


SPECTROSCOPY

PHOTOMETRY [IMAGES]

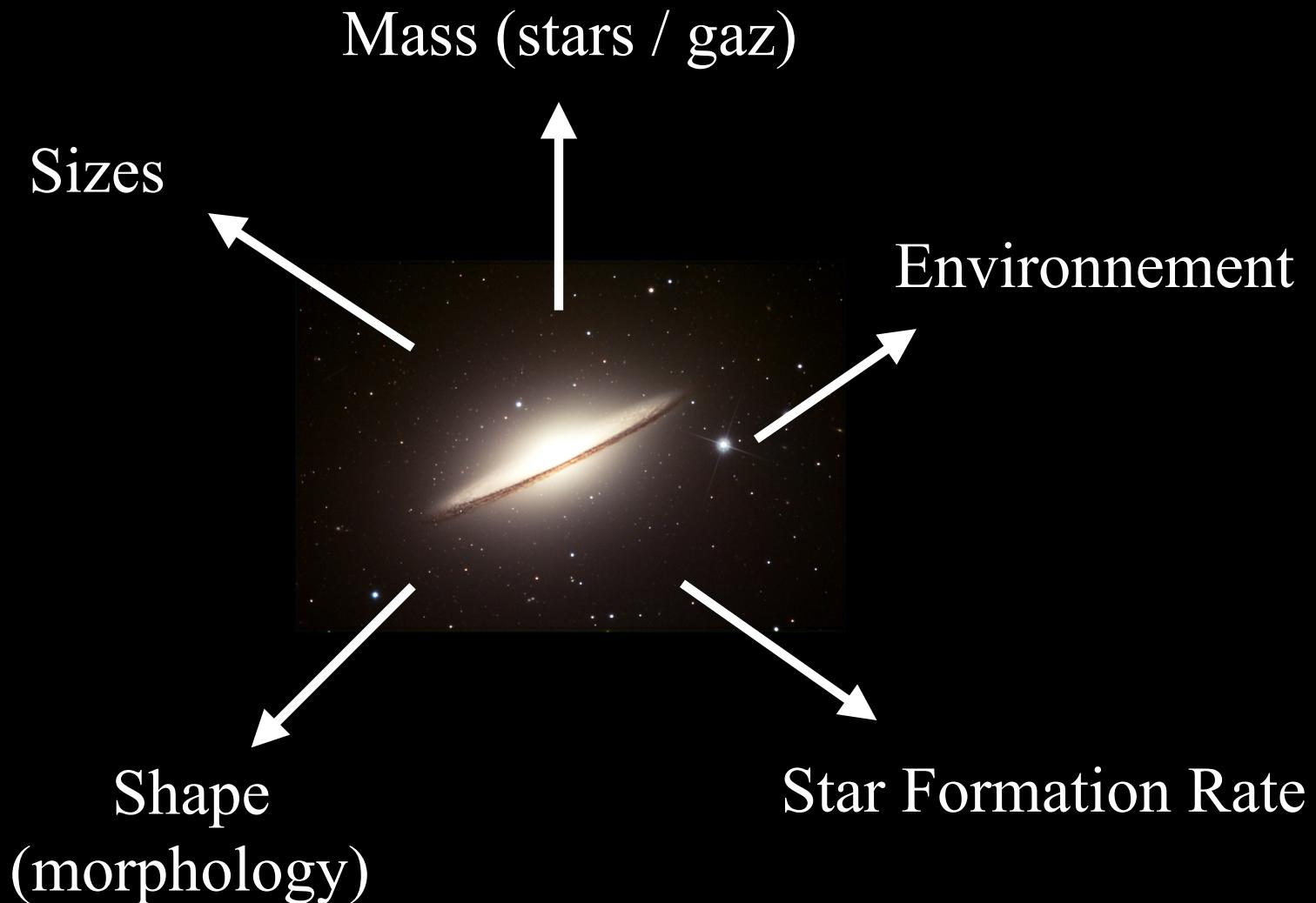


..MULTIWAVELENGTH (RADIO TO X)

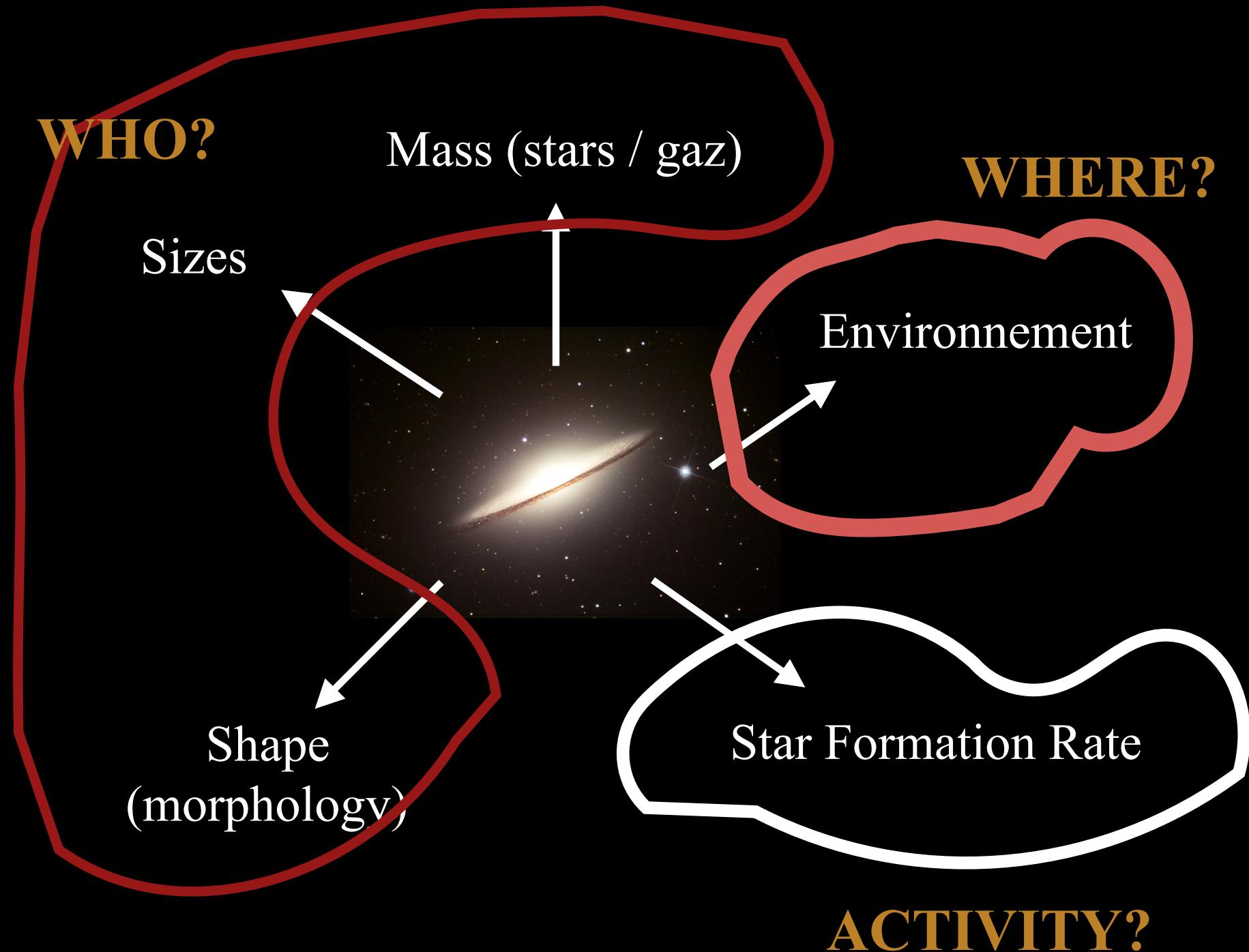


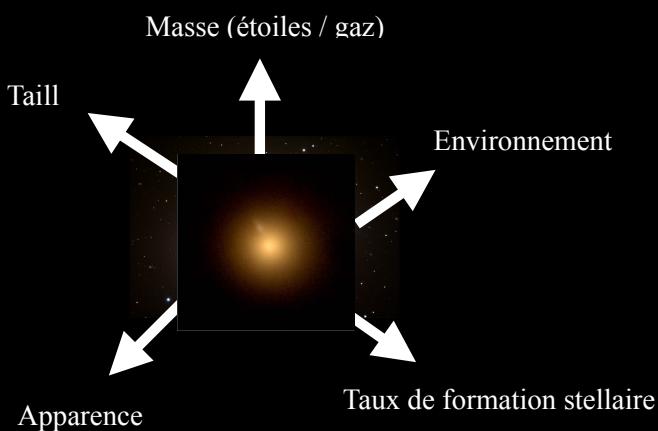
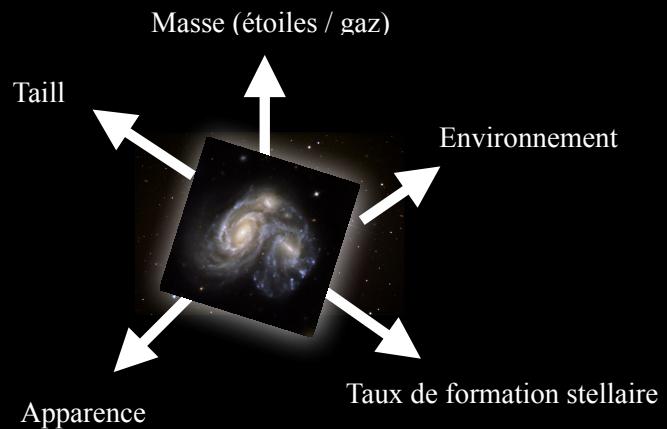
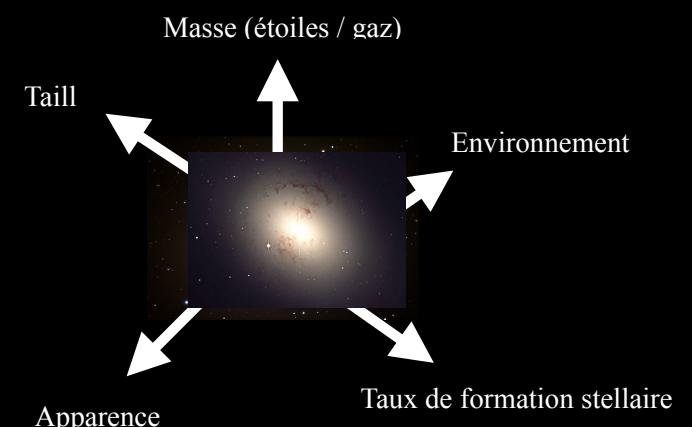
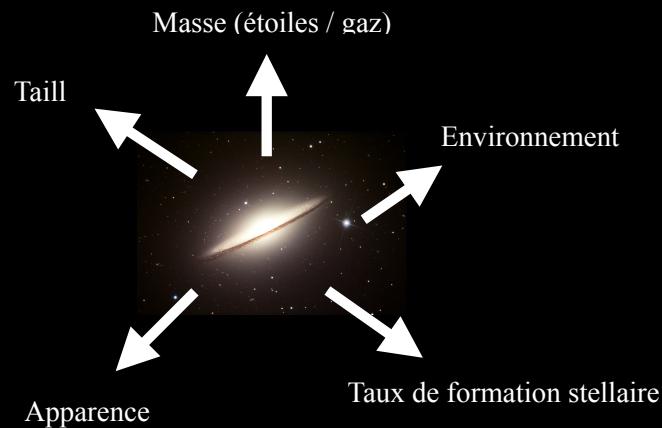
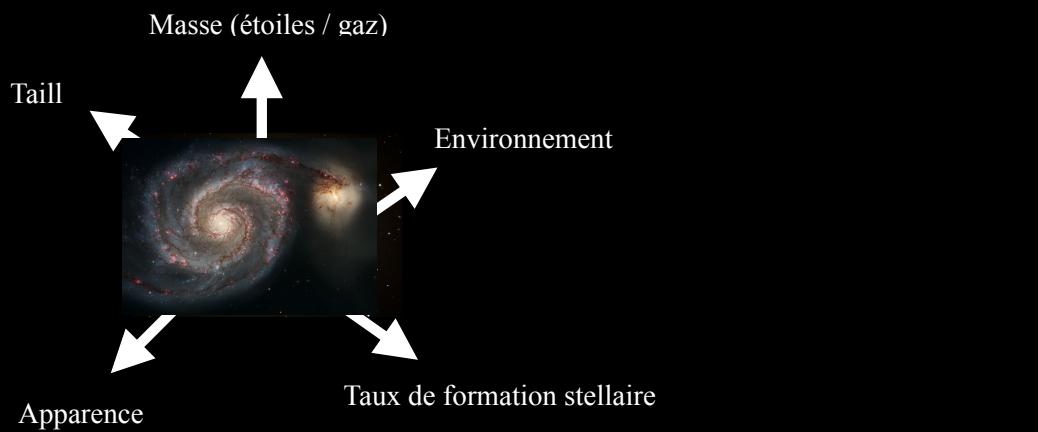
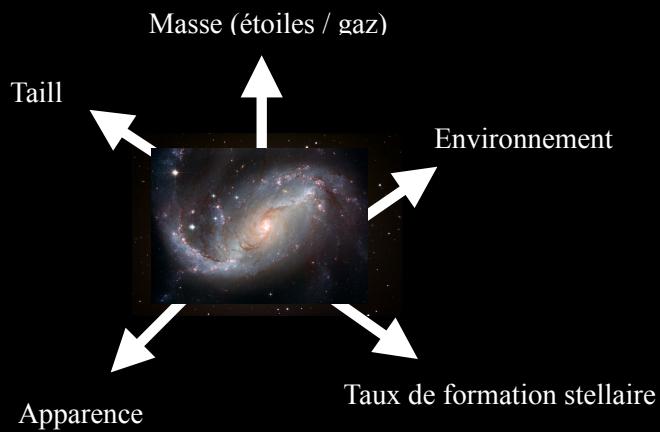
SPECTROSCOPY

THIS IS LIKE “A SOCIOLOGIC POLL”

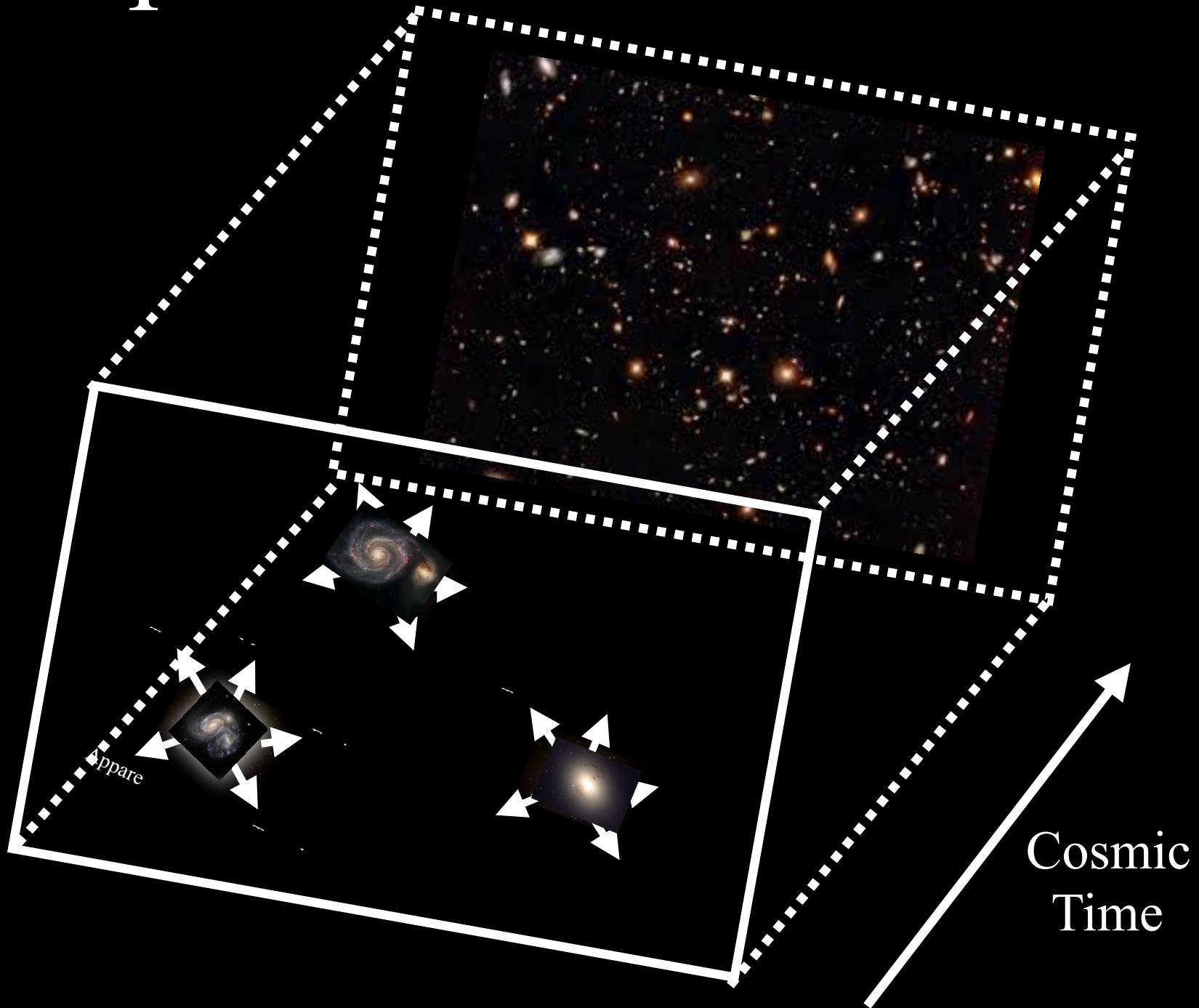


THIS IS LIKE “A SOCIOLOGIC POLL”

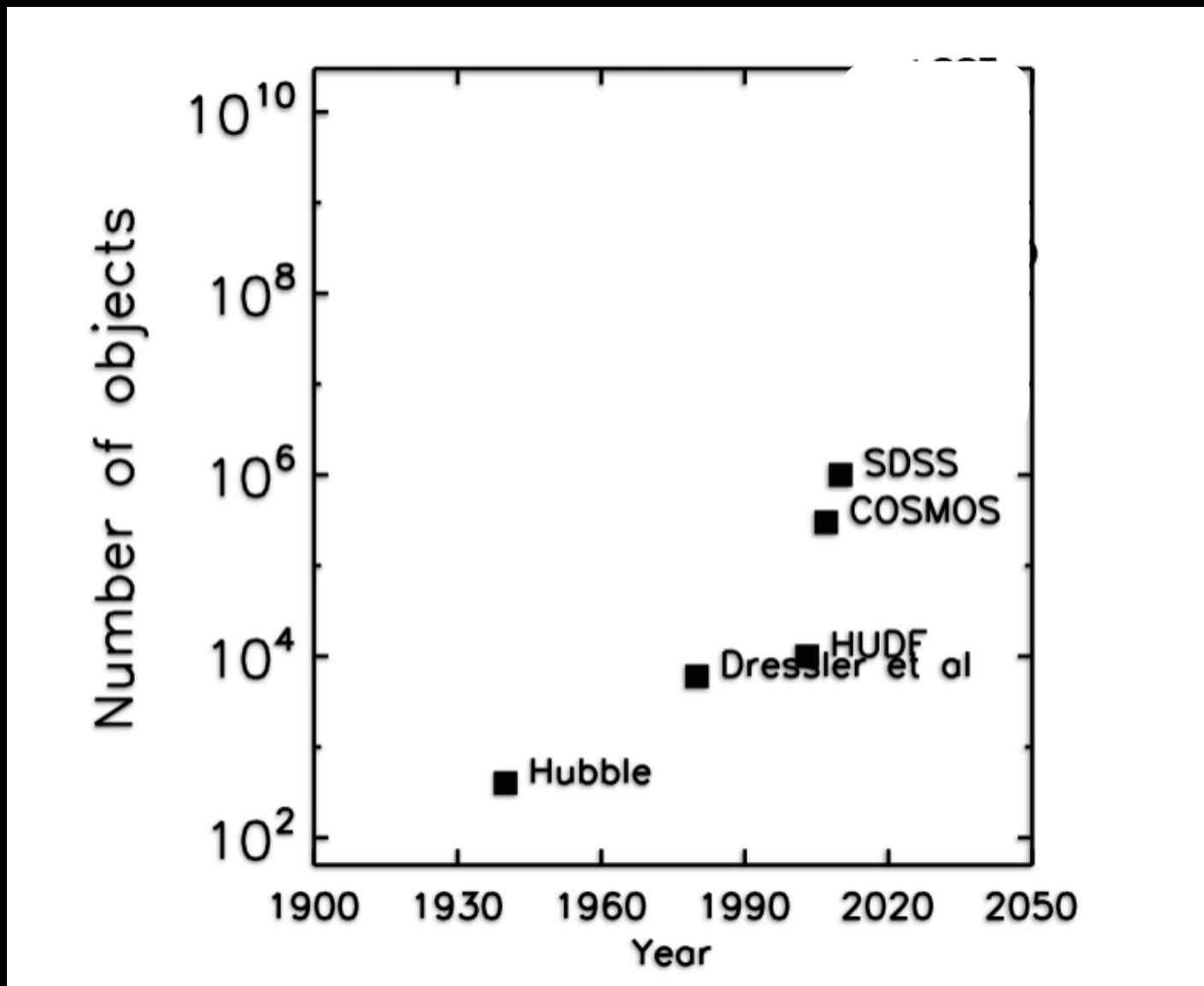




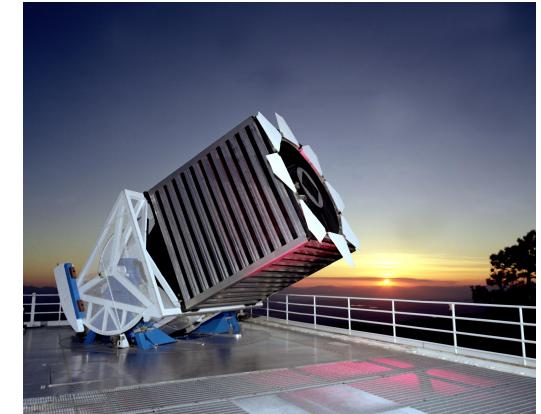
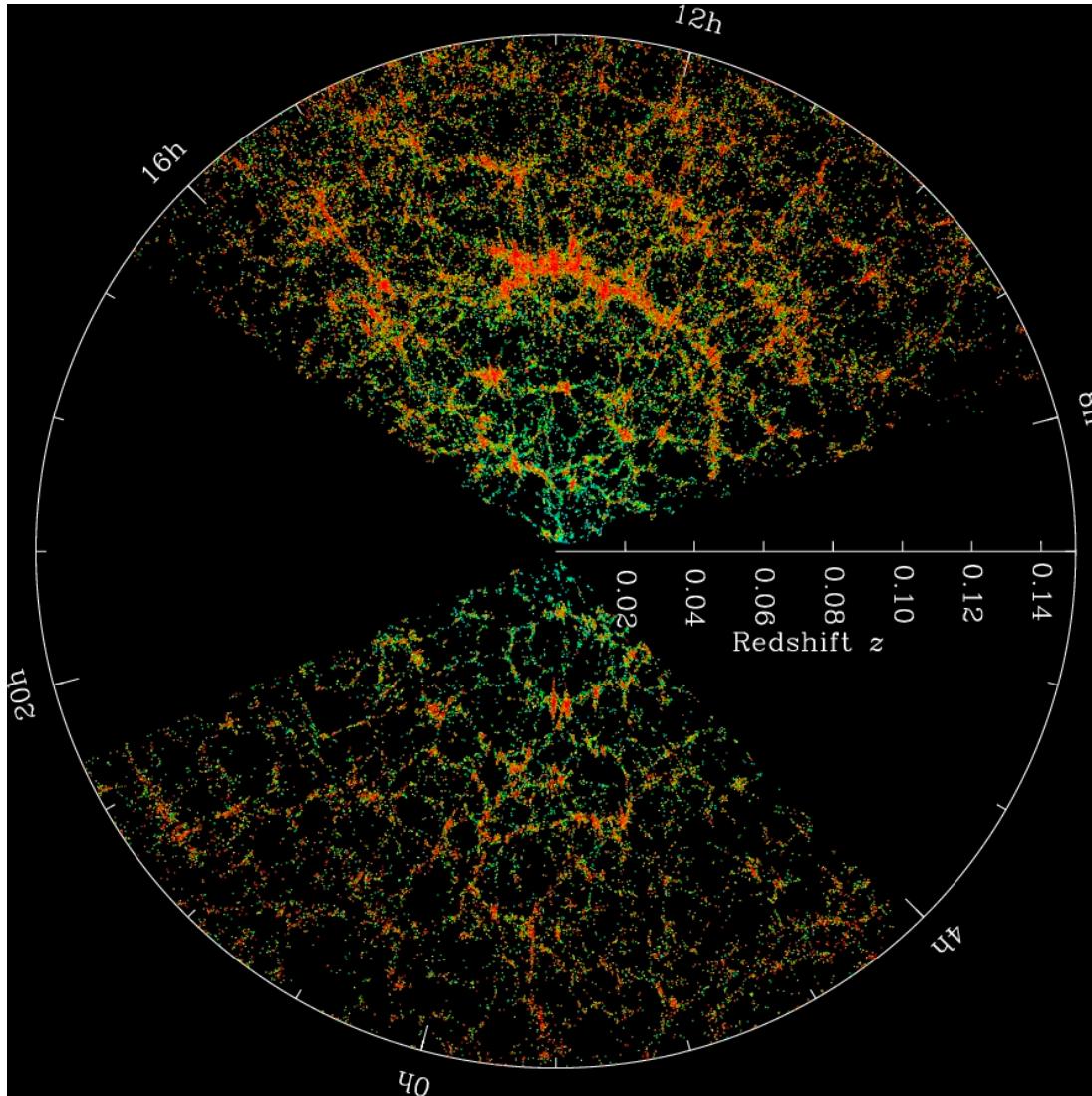
Repeated in “time” slices



Samples are becoming larger and larger.. (Optical / NIR)



SDSS SURVEY



2.5m

**REFERENCE CENSUS OF THE
LOCAL UNIVERSE**

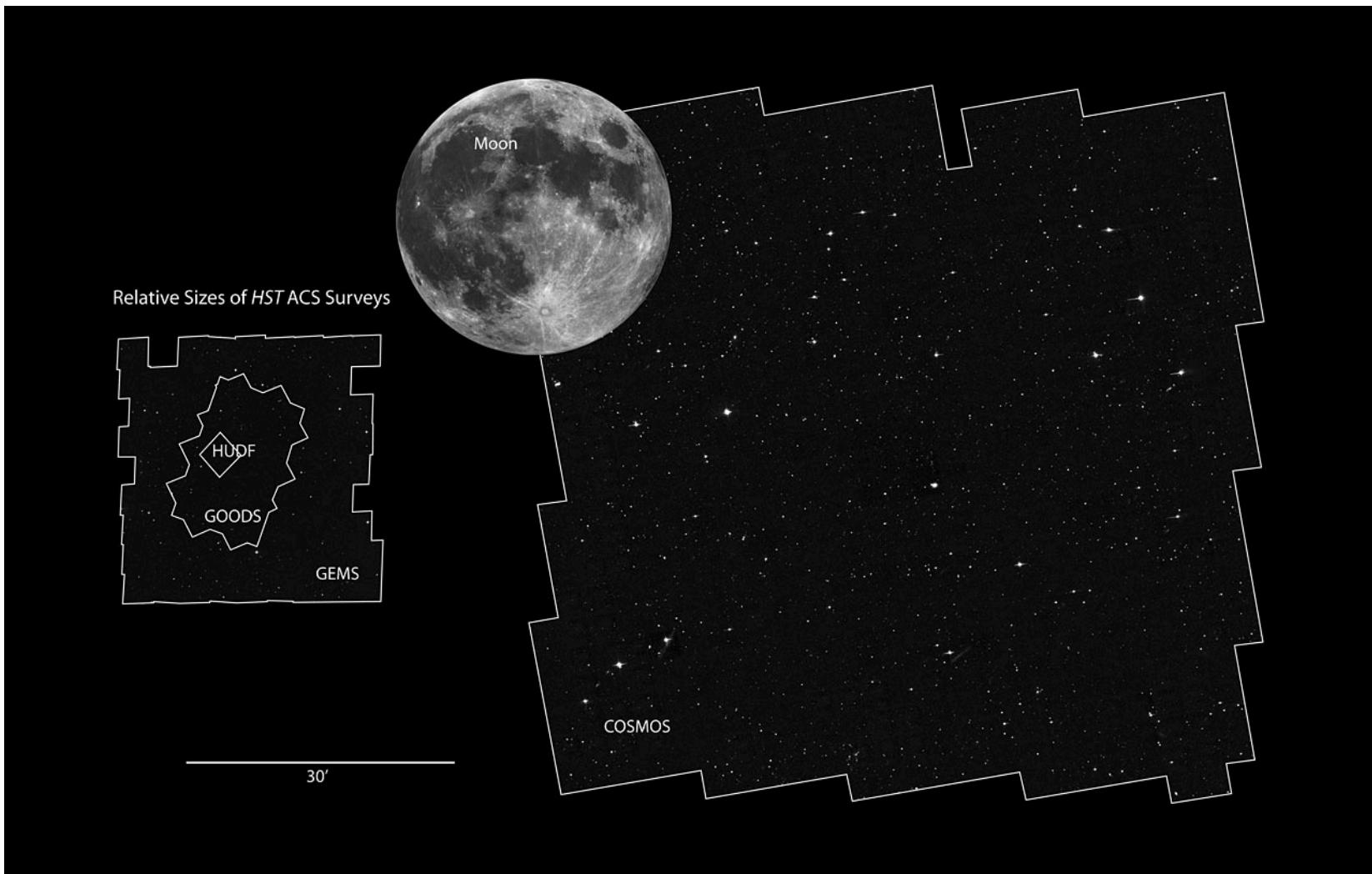
(IMAGING + SPECTROSCOPY)

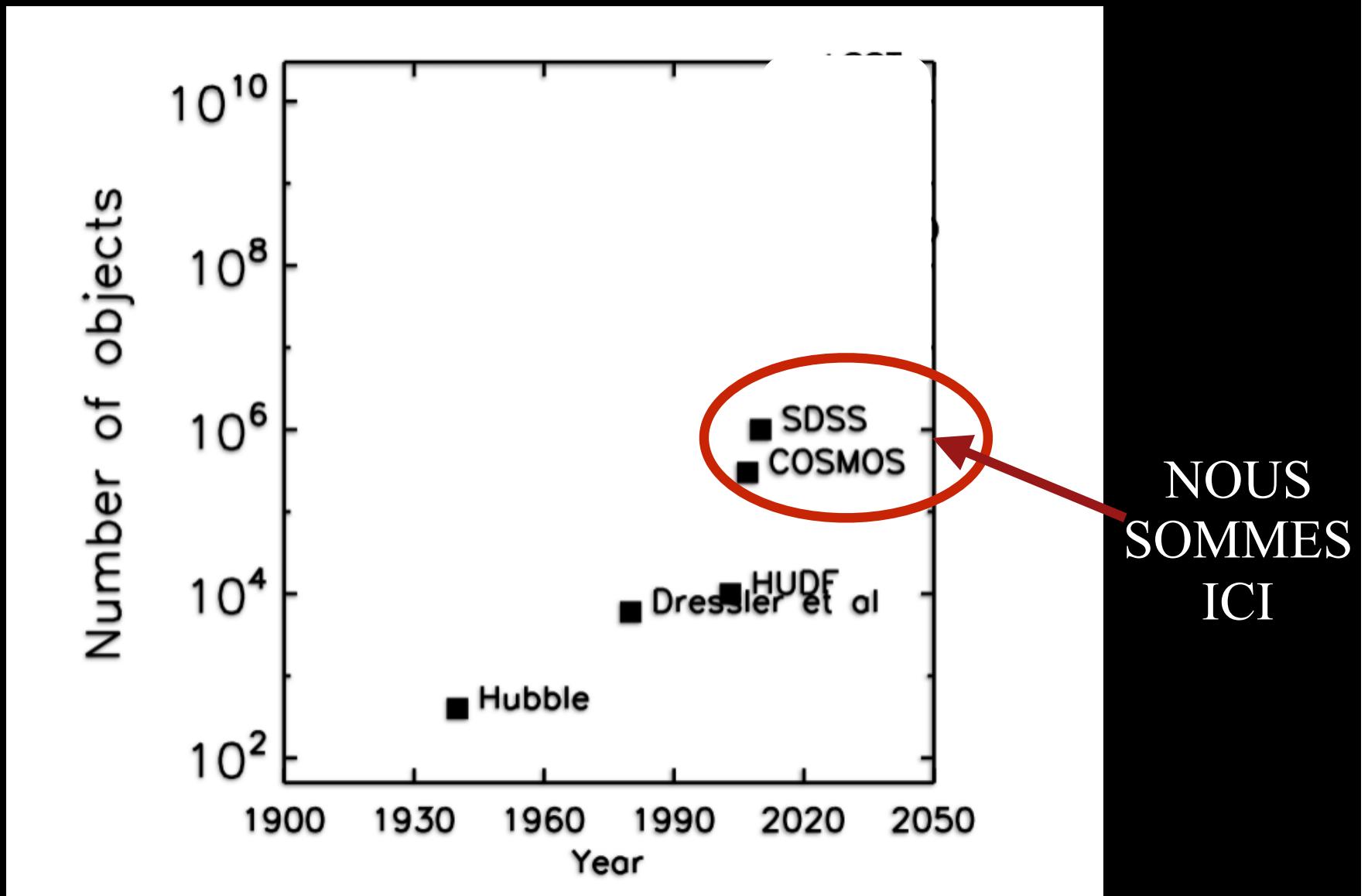
8000+ papers
400,000+ citations



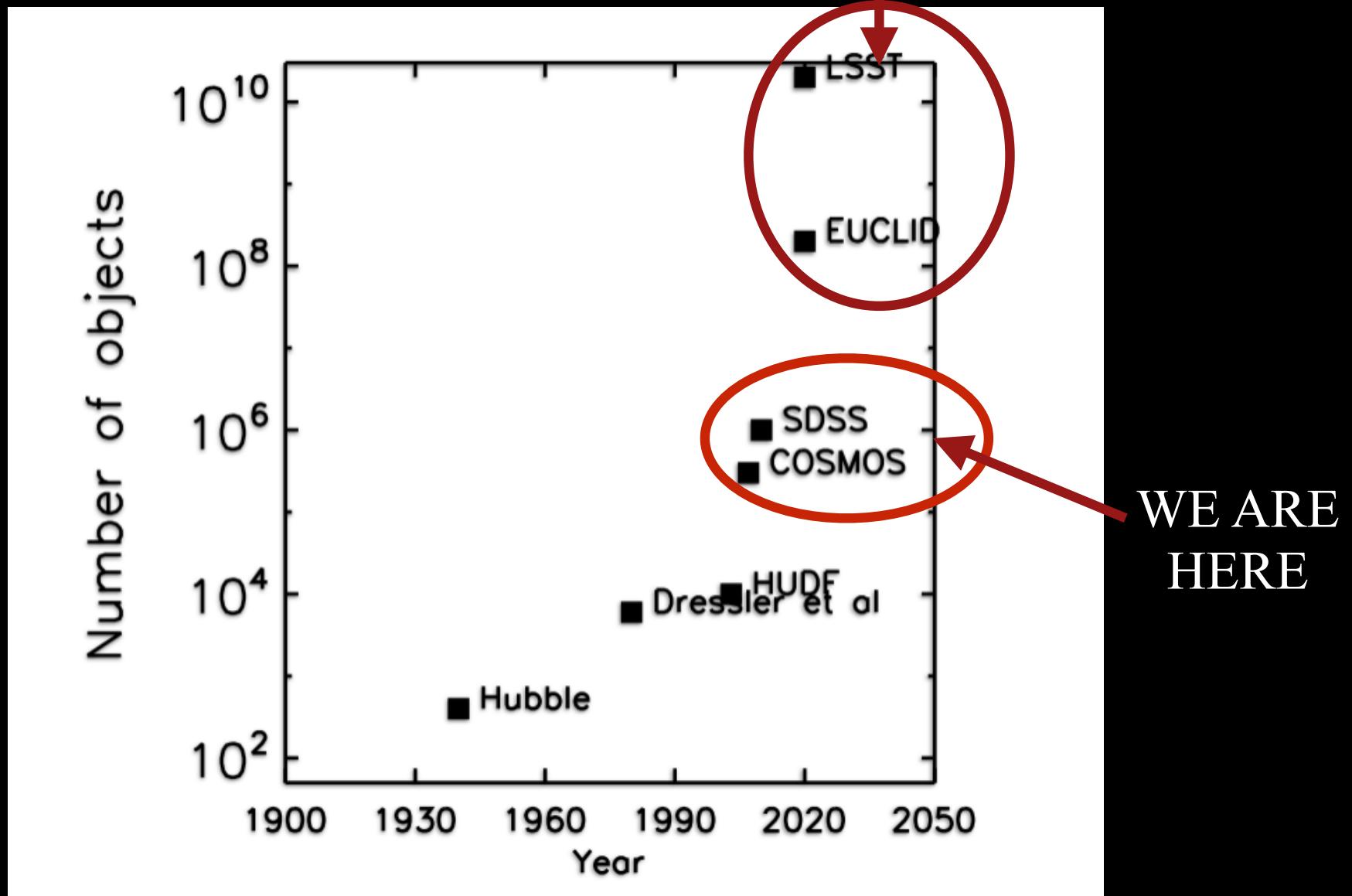
HST surveys

A WINDOW TO THE HIGH REDSHIFT
UNIVERSE

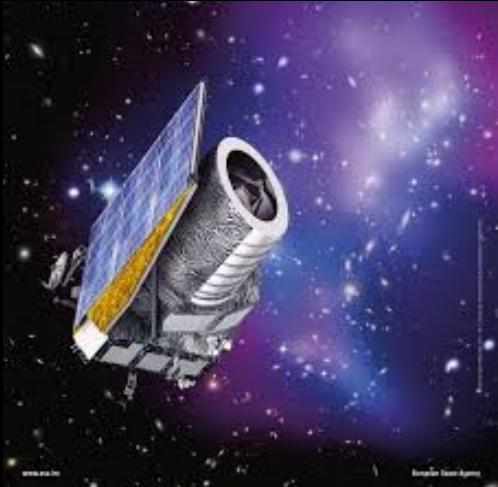




THE “BIG-DATA” REVOLUTION



EUCLID SPACE MISSION



ESA SPACE MISSION (+ NASA)

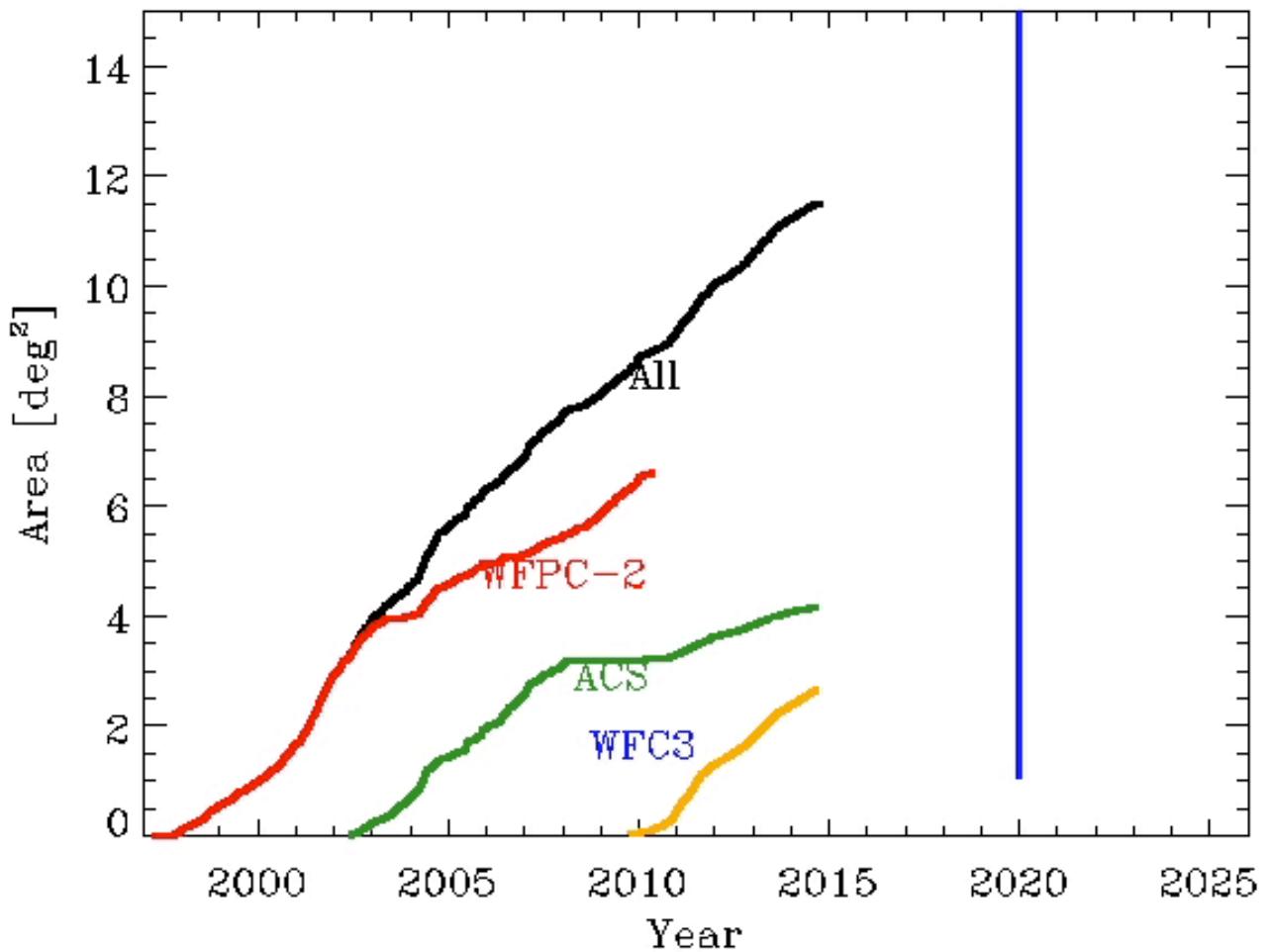
LAUNCH EXPECTED 2022



1.2m mirror (~HST)

OPTICAL / NIR IMAGING
+ SLITLESS SPECTROSCOPY

15,000 SQUARE DEGREES SURVEY....



WFIRST



LSST



DES



J-PAS

THIS IS LIKE “A SOCIOLOGIC POLL”

