



O BRASIL VERÁ QUASE TODAS AS GALÁXIAS OBSERVÁVEIS!

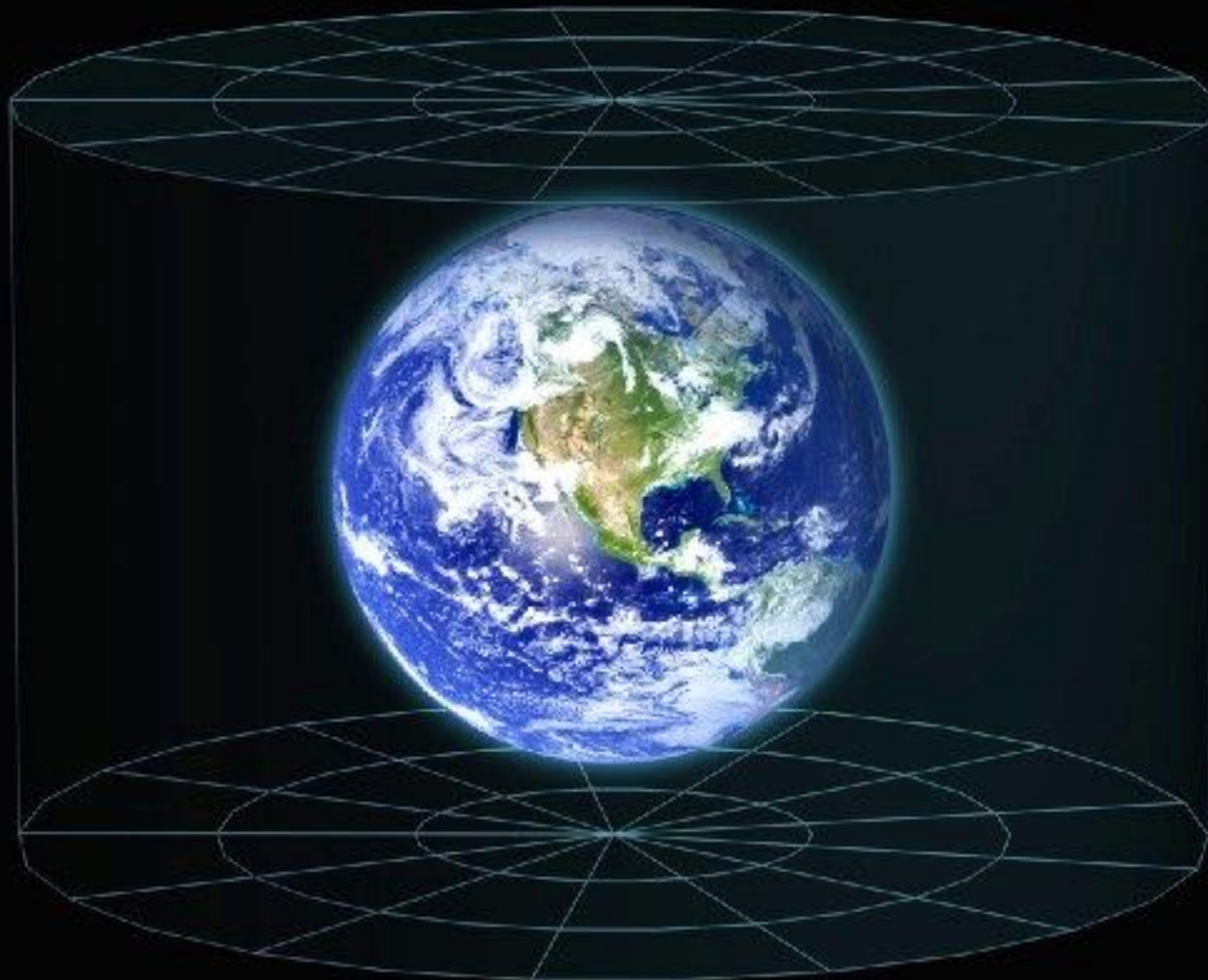
VALERIO MARRA



O universo

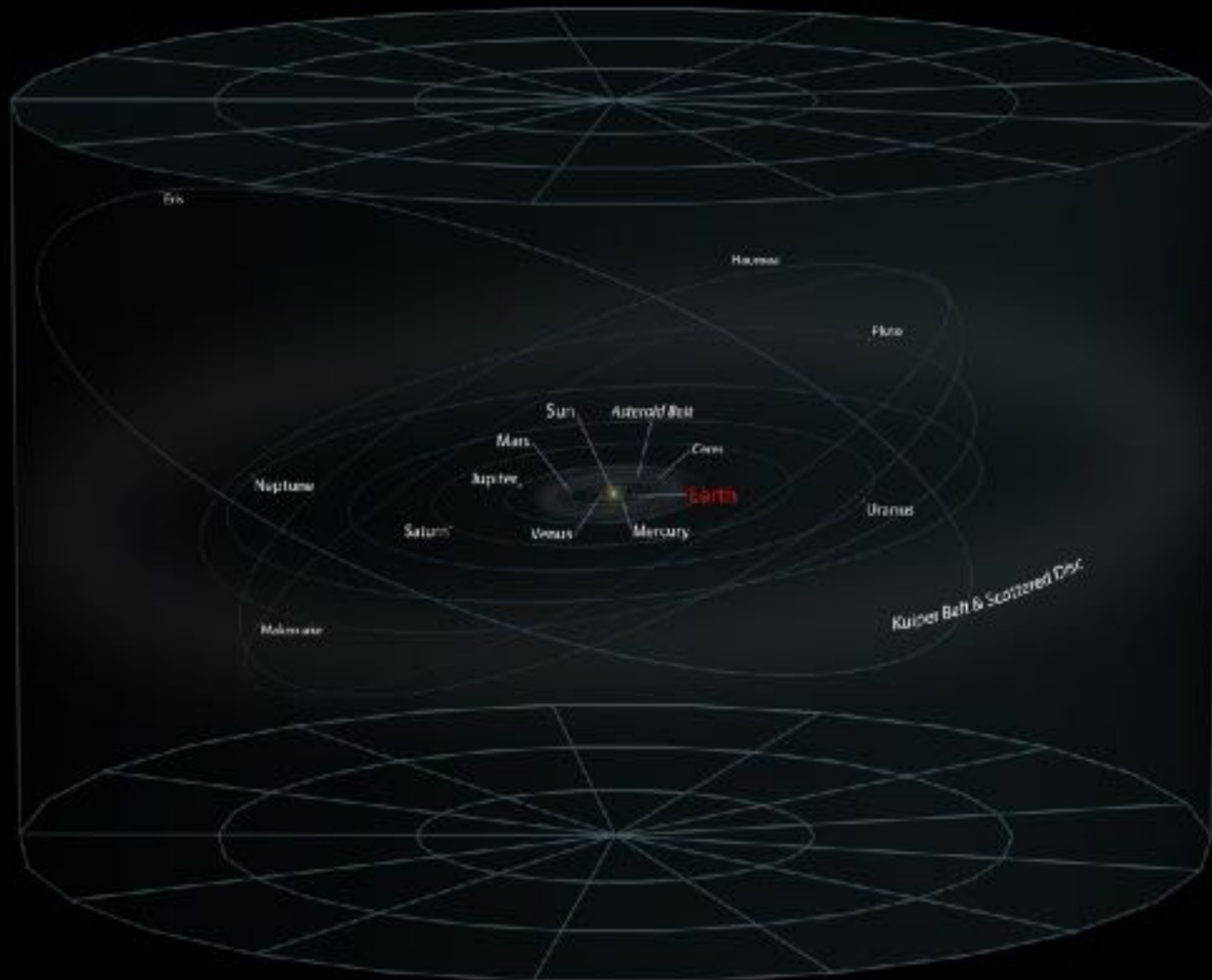
Where are we?

Earth



Where are we?

Solar System

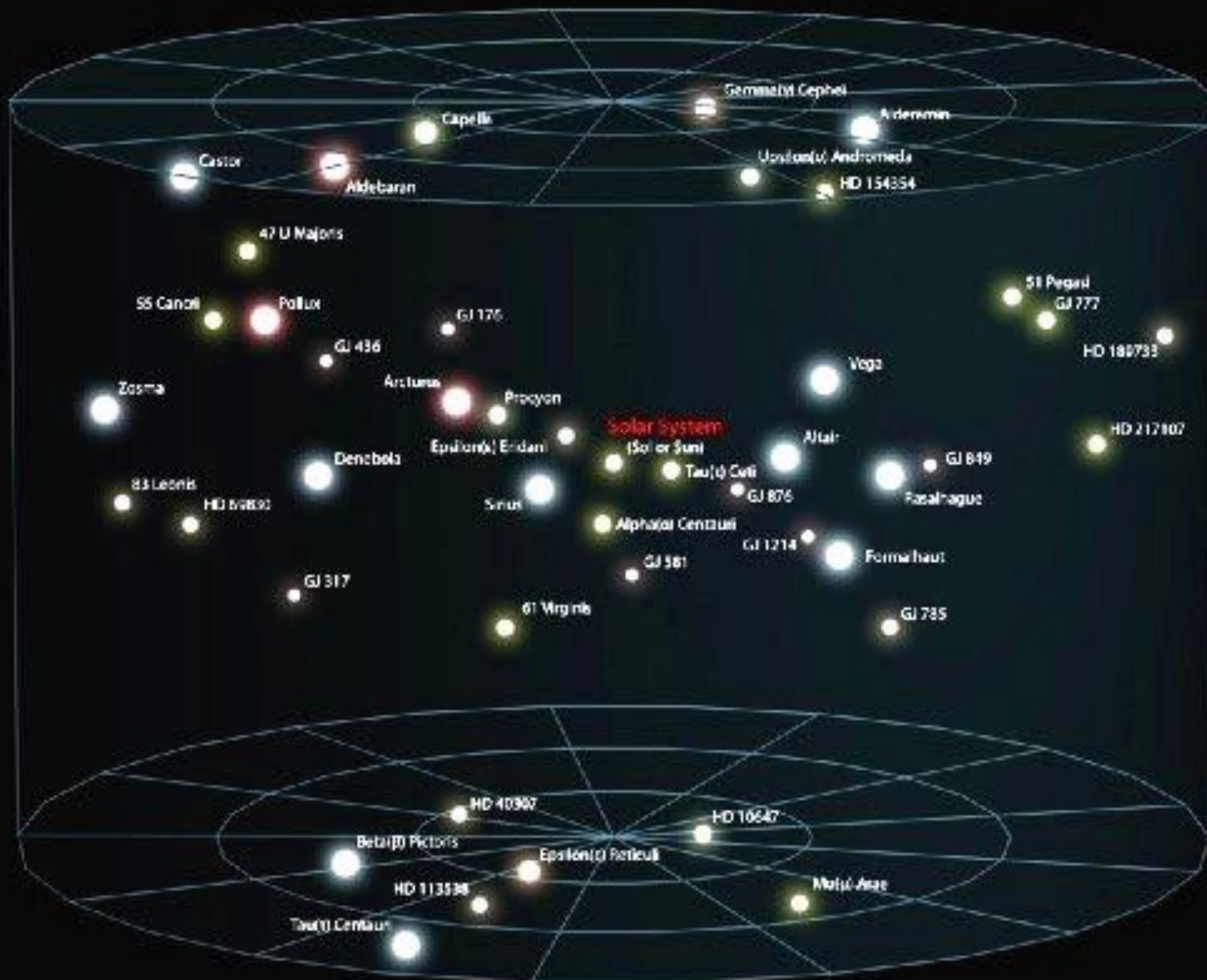


Solar



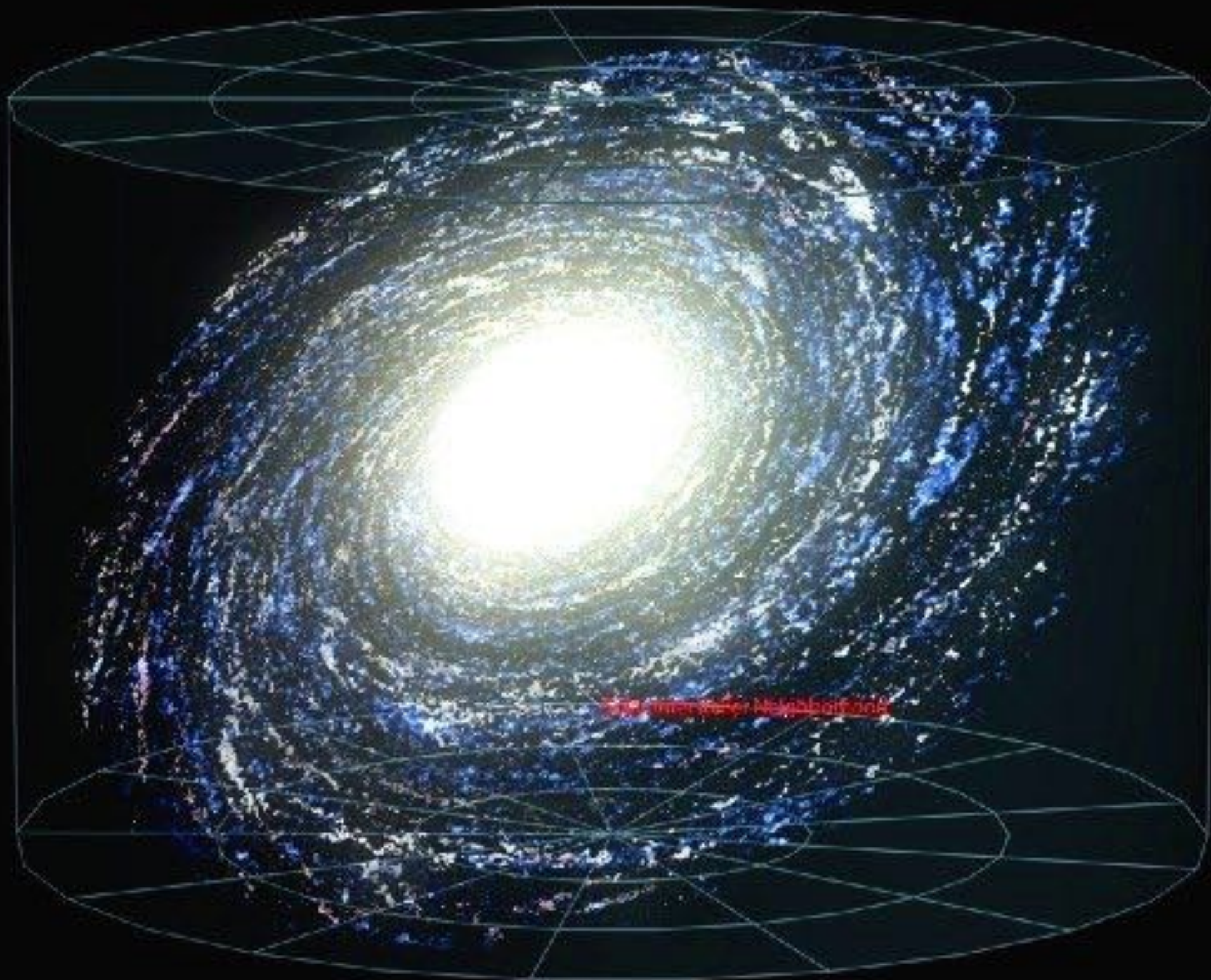
Where are we?

Solar Interstellar Neighborhood



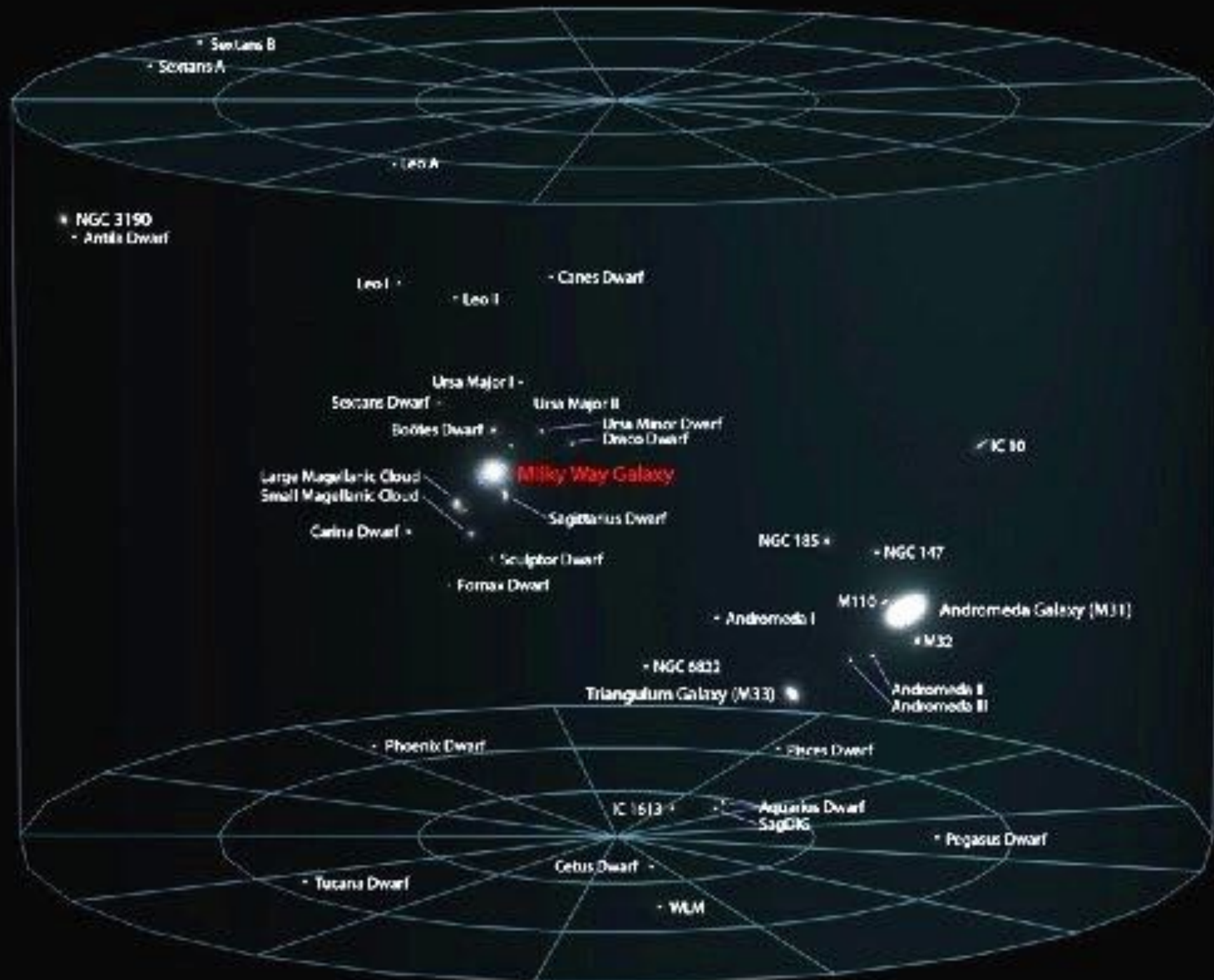
Where are we?

Milky Way Galaxy



Where are we?

Local Galactic Group



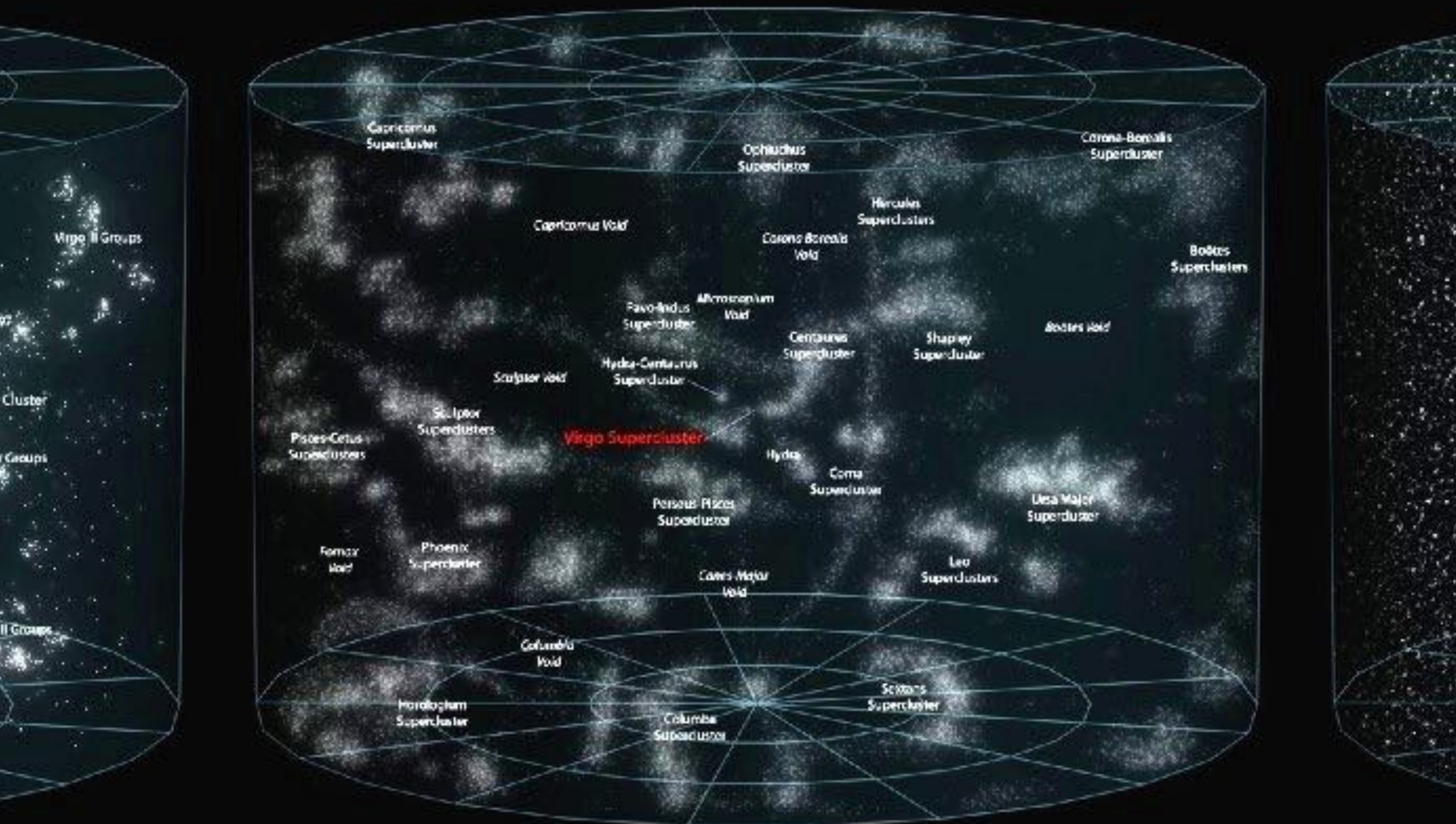
Where are we?

Virgo Supercluster



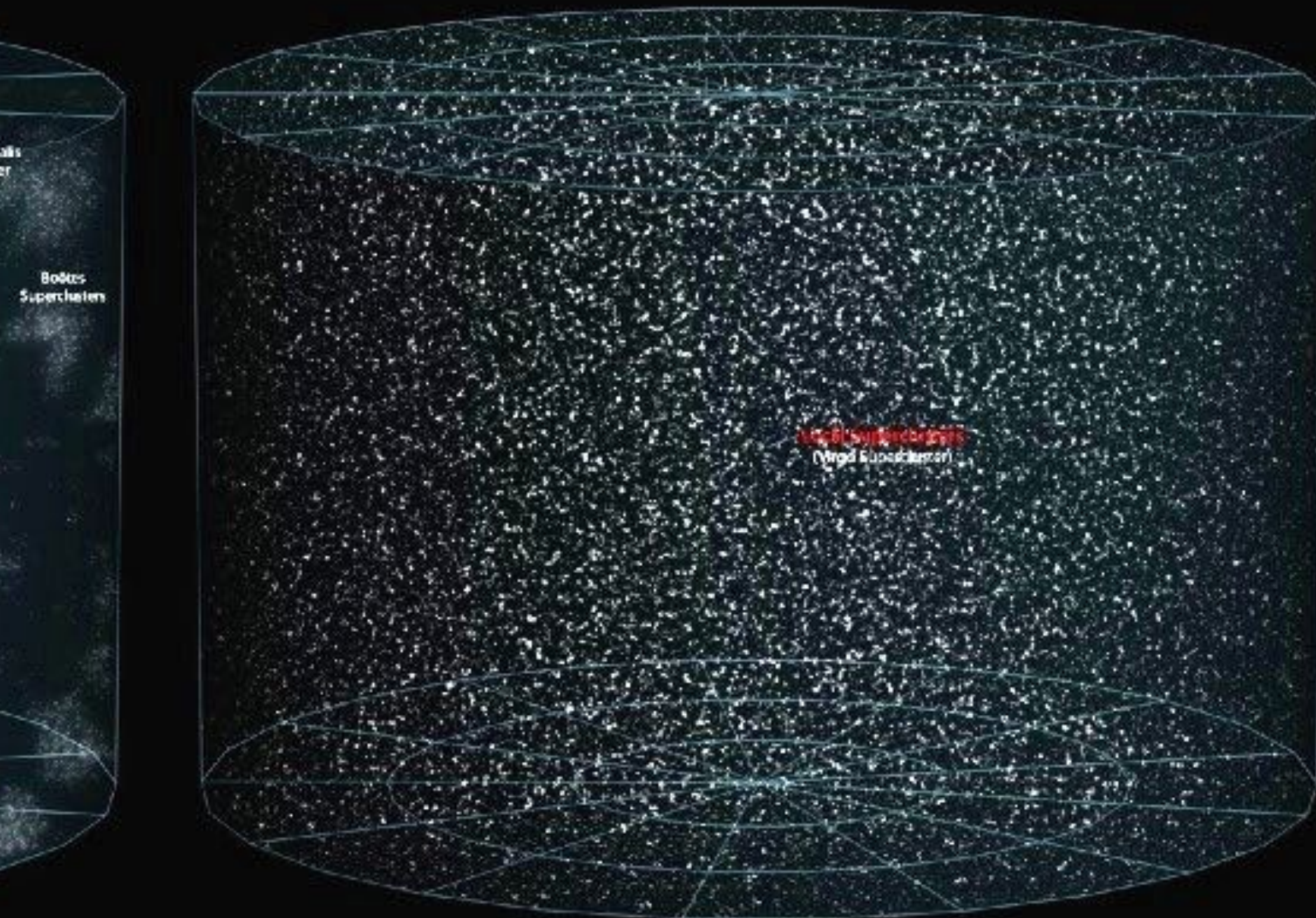
Where are we?

Local Superclusters



Where are we?

Observable Universe



Distance to...

Speed of light = 300,000 kilometers per second

Around the Earth = $1/7$ light seconds

Earth-Moon = 1 light seconds

Earth-Sun = 8 light minutes

Earth-Pluto = 5 light hours

Earth-nearest star (Alpha Centauri) = 4 light years

Earth-center of Milky Way = 26,000 light years = 8,000 parsec

Earth-nearest galaxy (Andromeda) = 2,500,000 light years

Earth-Sloan Great Wall = 1,000,000,000 light years

Earth-farthest supernova = 15,000,000,000 light years

Earth-CMB = 45,000,000,000 light years

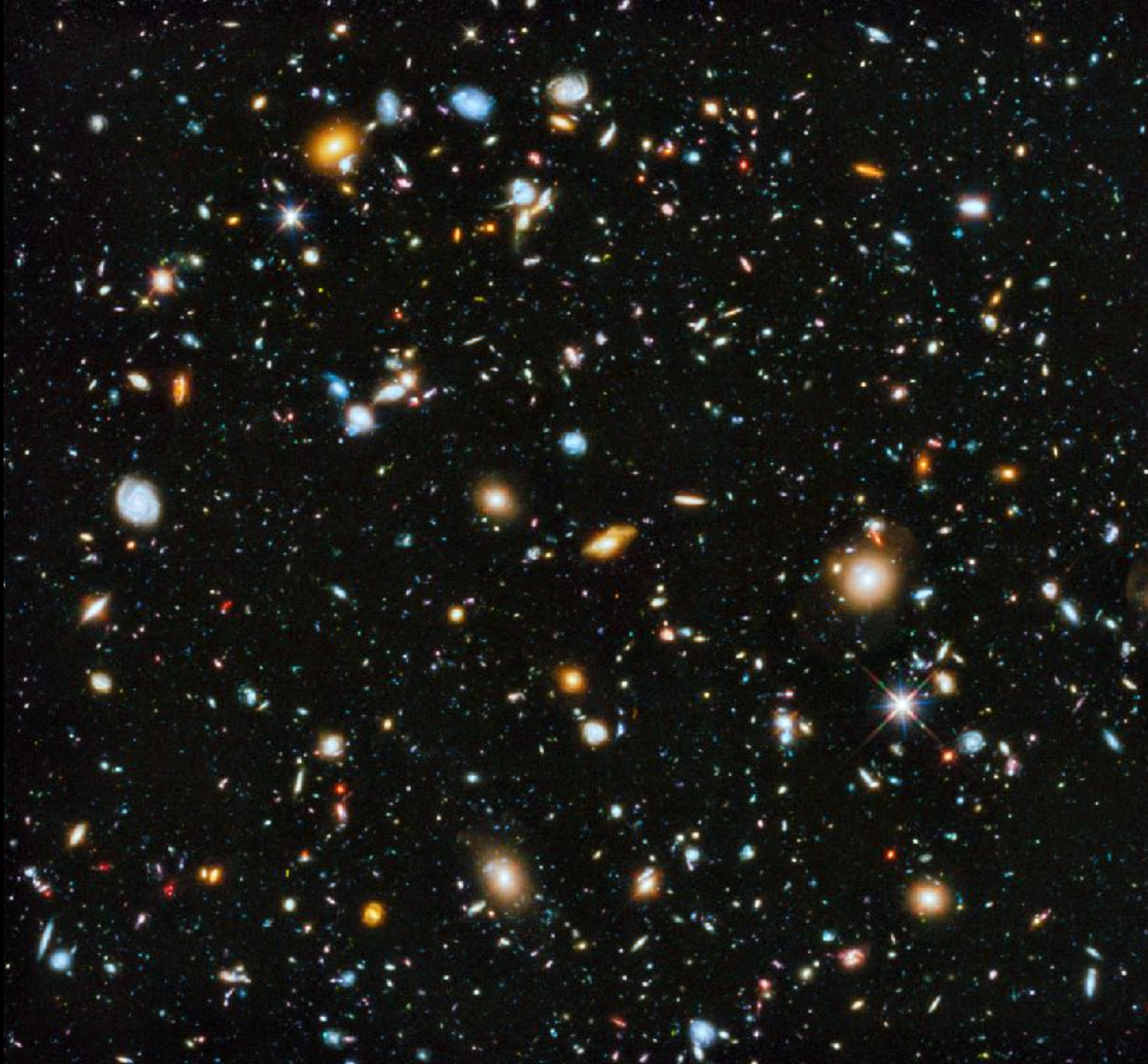
August 2016: Astronomers detected an Earth-size planet orbiting the habitable zone of Proxima Centauri.



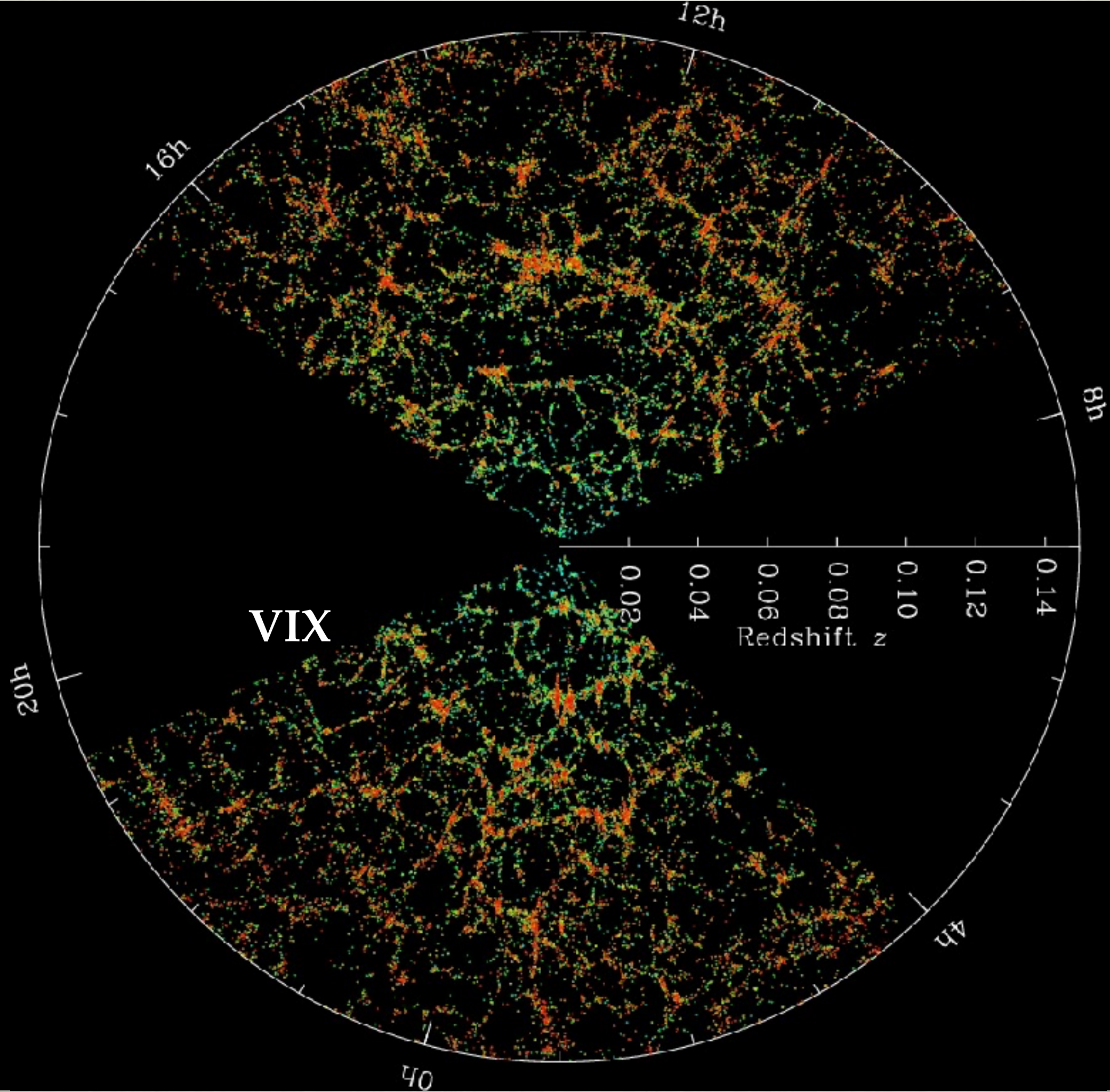
1 parsec = 3.3 light years

Hubble Ultra Deep Field

**10,000
individual
galaxies**



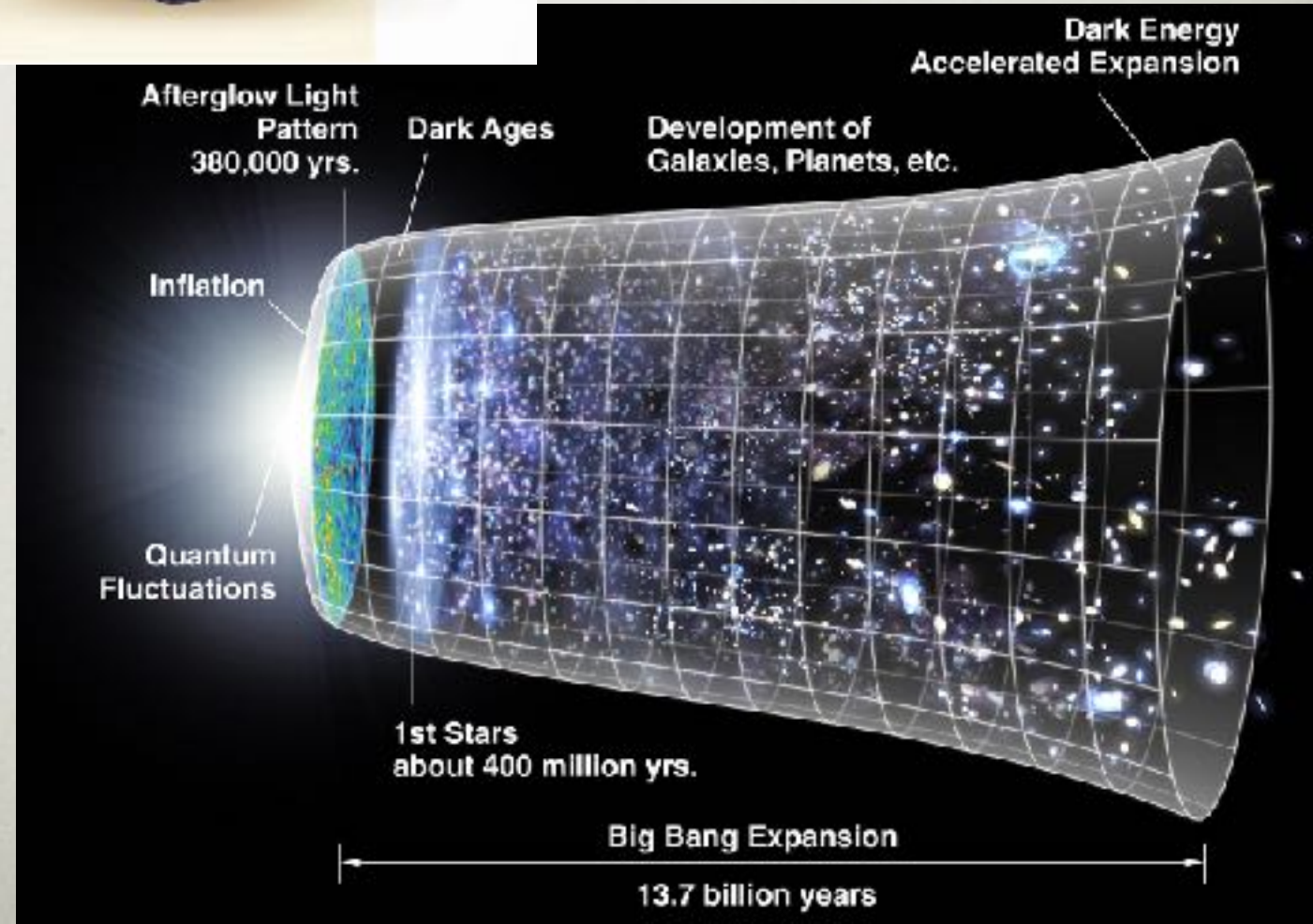
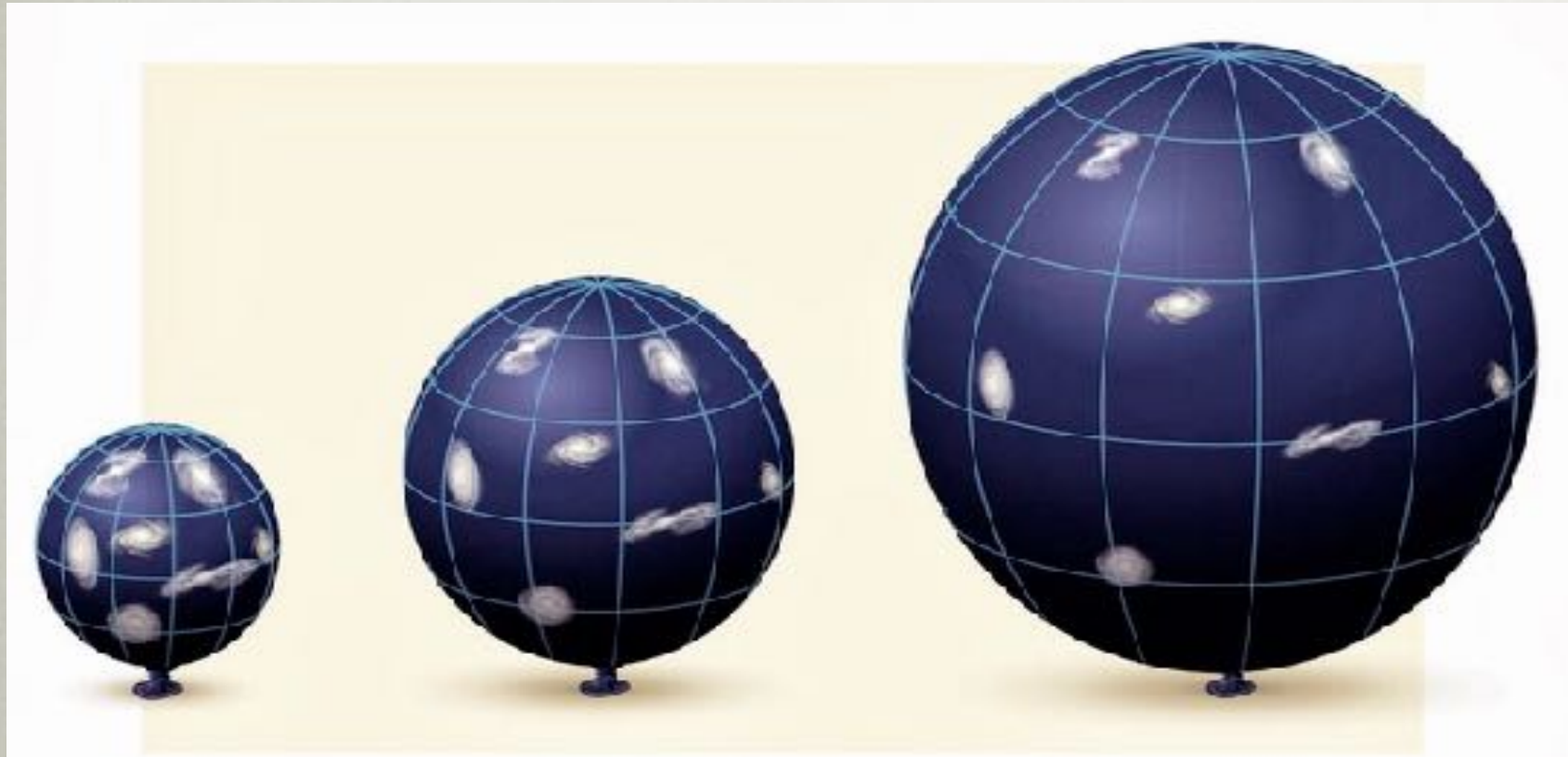
Para as escalas cosmológicas,
as galáxias - e seus bilhões de
estrelas e planetas - são...
pontos!



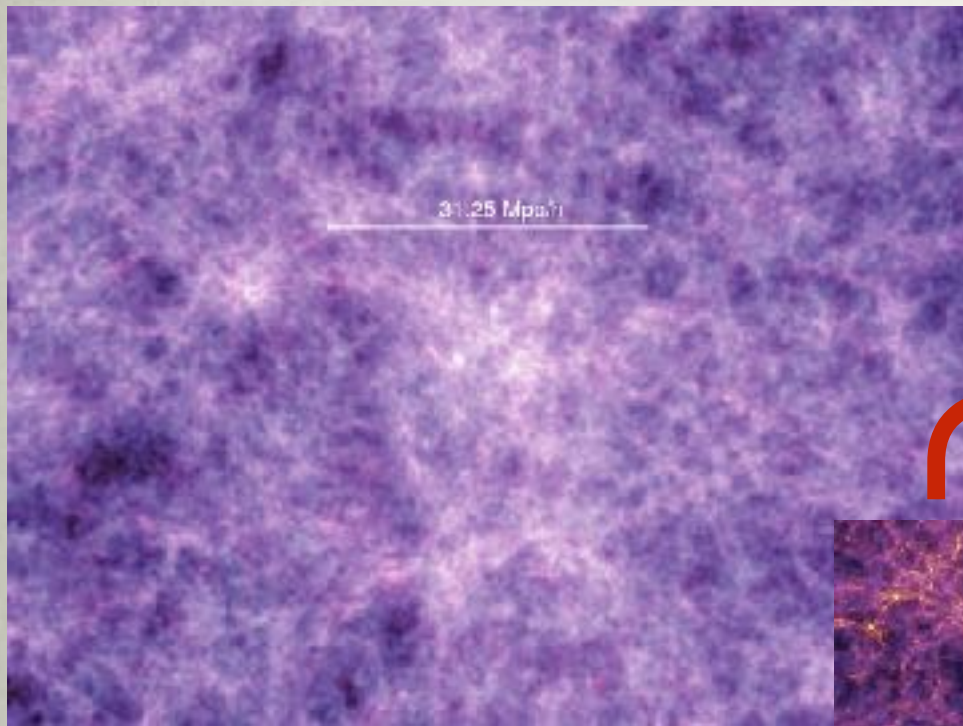
O que é a cosmologia (moderna)?

O que pretende descobrir?

1- A evolução do “tamanho” do universo

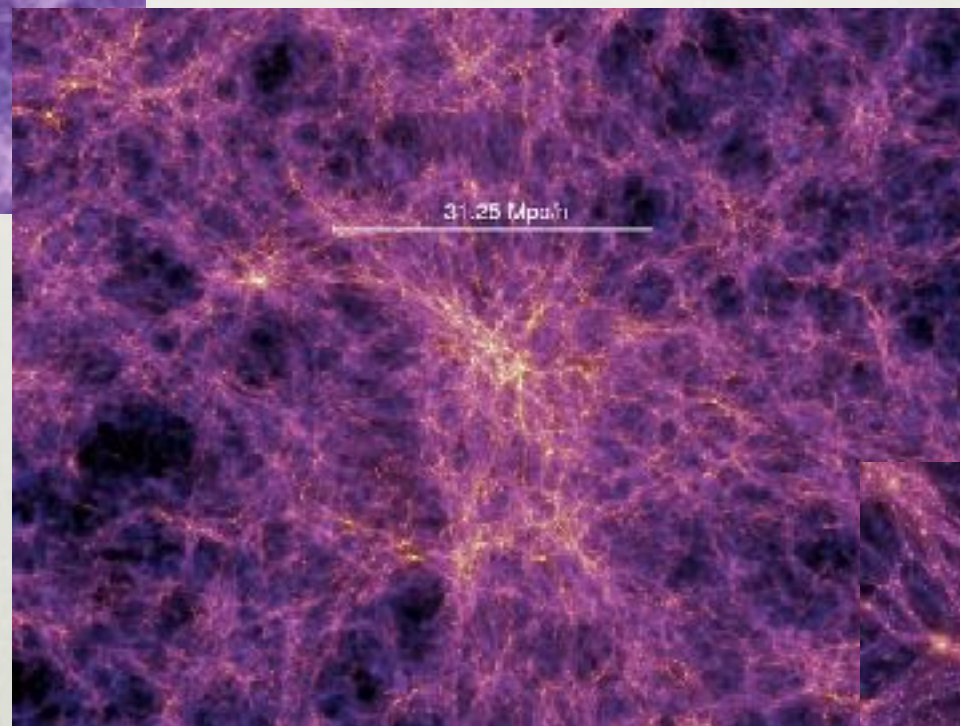


1- A evolução da estrutura em larga escala



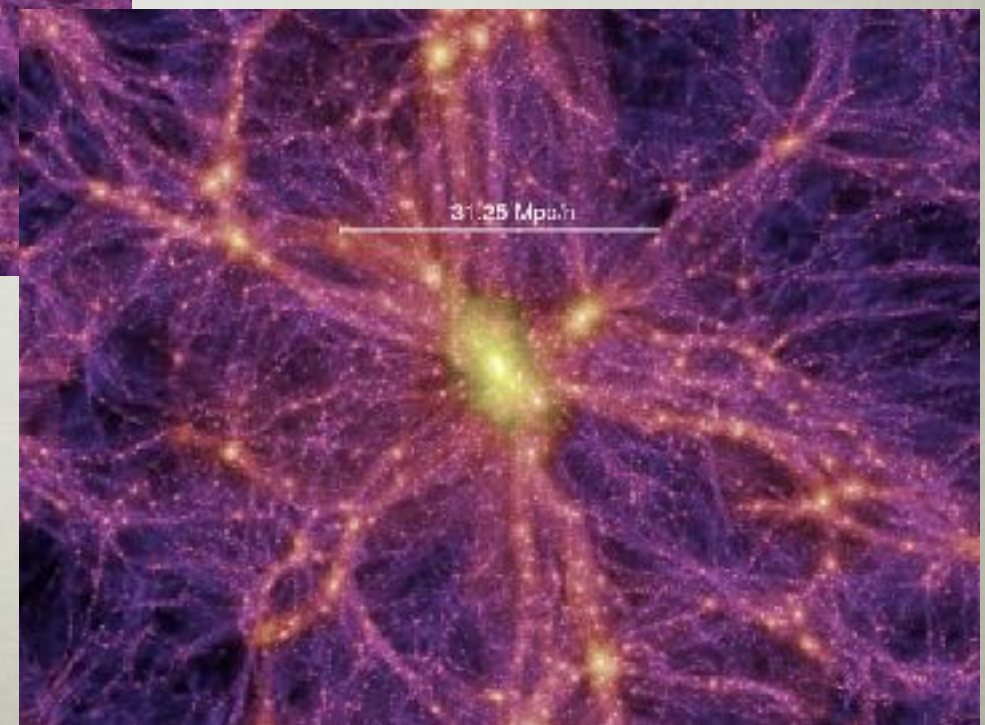
$t = 0.21 \text{ Gyr}$

400,000,000 anos luz



$t = 4.7 \text{ Gyr}$

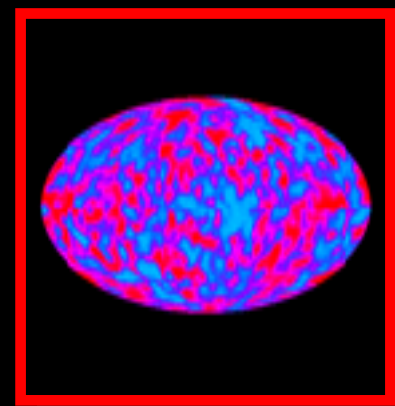
$t = 13.6 \text{ Gyr}$



Consequências?

Inimagináveis!

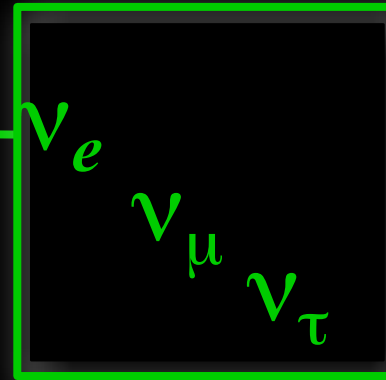
Em particular, descobriremos a composição do universo e as leis da física que governam não somente nossa galáxia mas o universo inteiro.



Radiation:
0.005%



Chemical Elements:
(other than H & He) 0.025%



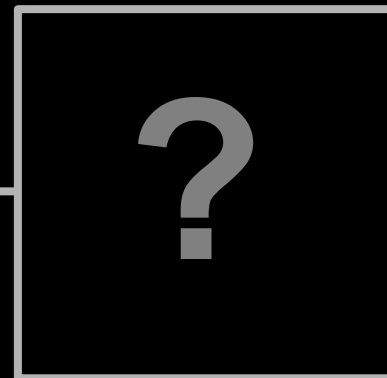
Neutrinos:
0.17%



Stars:
0.8%



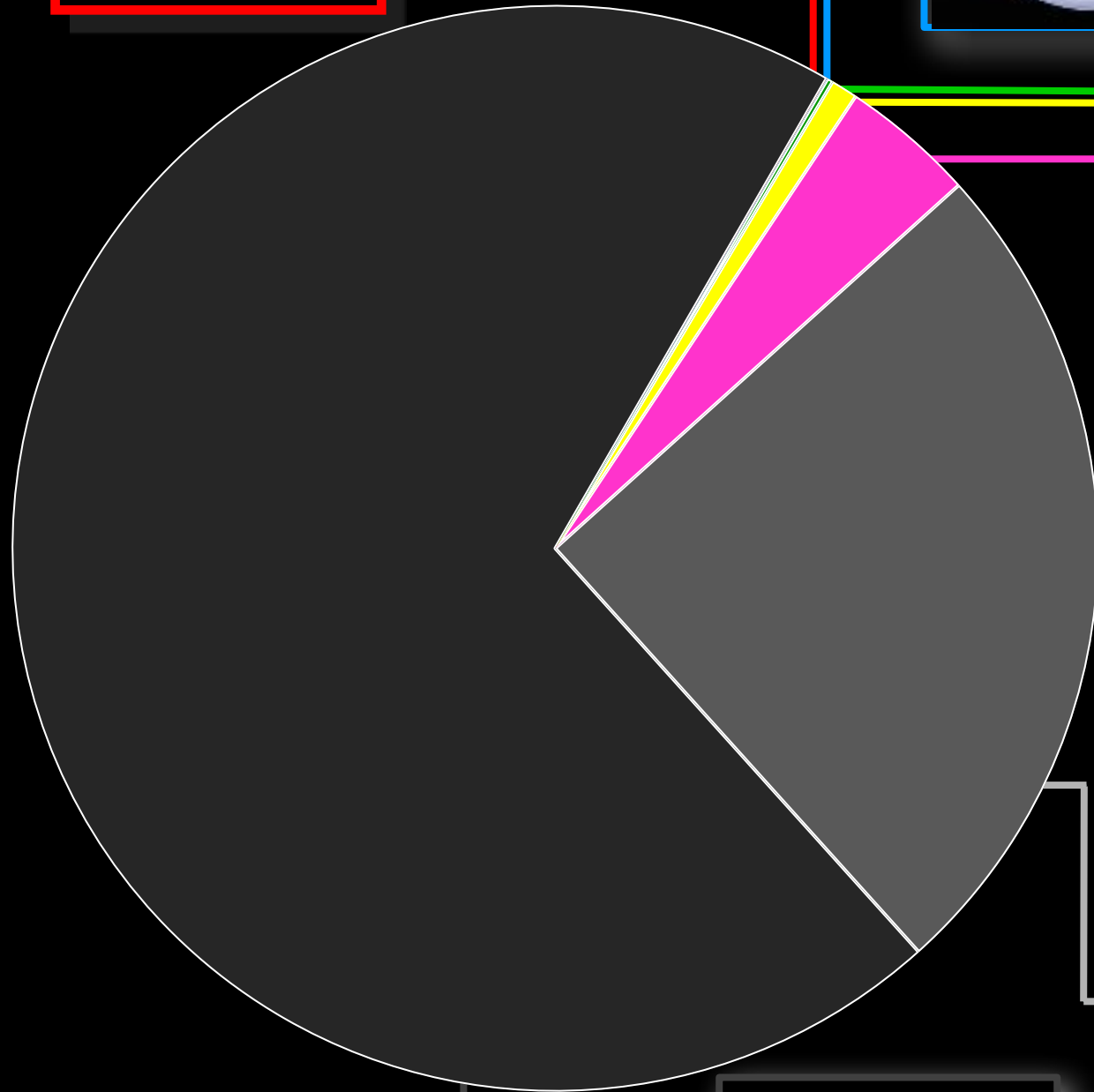
H & He:
gas 4%



Dark Matter: 25%



Dark Energy: 70%



Como conseguirá o Brasil
fazer tudo isso?

Observando 100 milhões
de galáxias!

J-PAS: The Javalambre-Physics of the Accelerated Universe Astrophysical Survey

J-PAS was founded on the grounds of a MoU signed by CEFCA (Teruel, Spain), USP and ON.

SPAIN

Fondo de Inversiones de Teruel



Gobierno de Aragón



Ministerio de economía y competitividad



Araid



CSIC



BRAZIL

Ministério da Ciência, Tecnologia e Inovação



FAPESP



FINEP



FAPERJ



R\$ 100 milhões: R\$1/galáxia.
Euclid é 20 vezes mais caro.

J-PAS: The Javalambre-Physics of the Accelerated Universe Astrophysical Survey

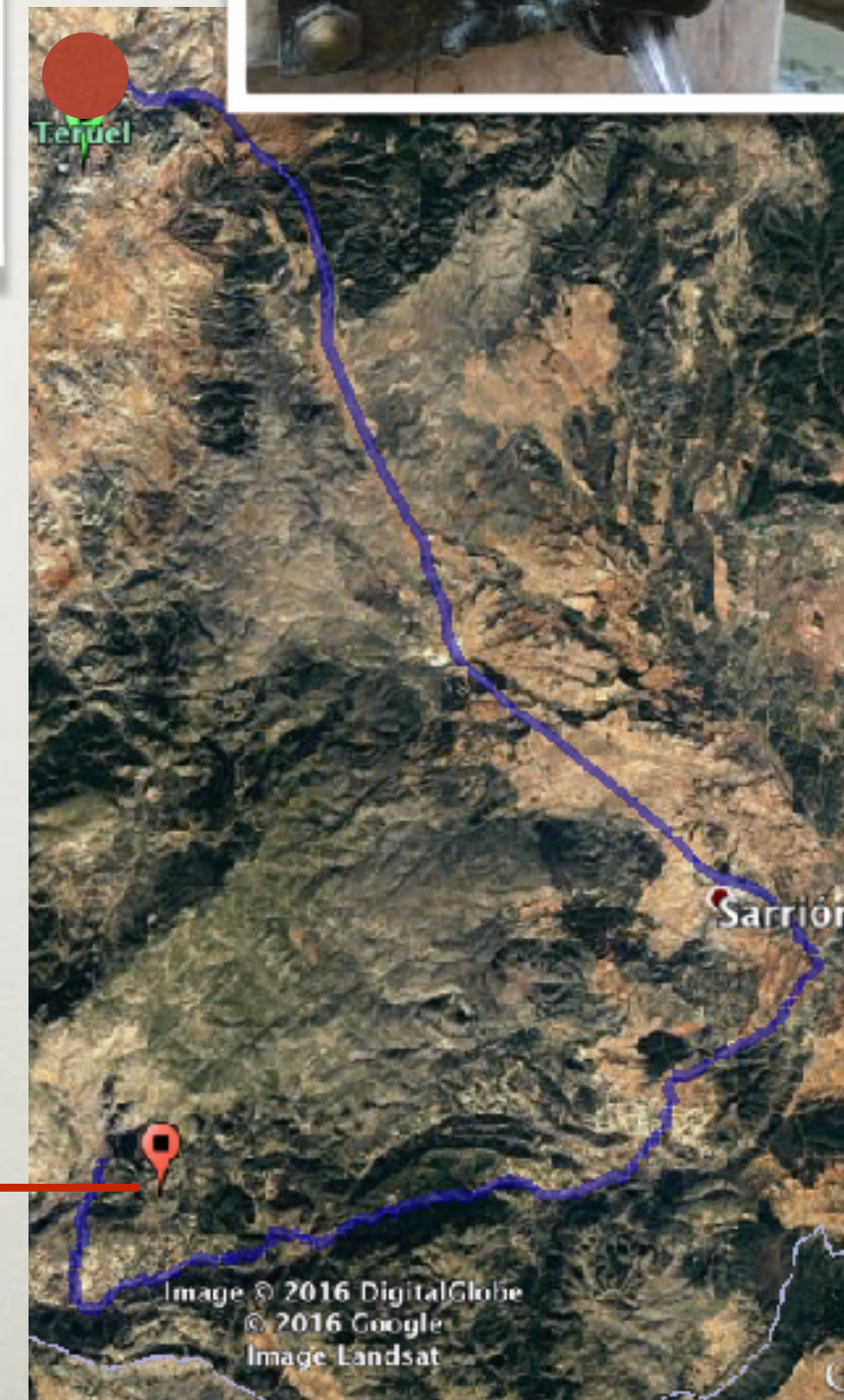
Redbook: [arxiv.org / abs / 1403.5237](https://arxiv.org/abs/1403.5237)

The Javalambre-Physics of the Accelerated Universe Astrophysical Survey (J-PAS) is a narrow band, very wide field Cosmological Survey to be carried out from the Javalambre Observatory in Spain with a purpose-built, dedicated 2.5m telescope and a 4.7° camera with 1.2Gpix. Starting in 2017, J-PAS will observe 8500° of Northern Sky and measure $0.003(1+z)$ precision photometric redshifts for 9×10^7 LRG and ELG galaxies plus several million QSOs, about 50 times more than the largest current spectroscopic survey, sampling an effective volume of $\sim 14 \text{ Gpc}^3$ up to $z = 1.3$. J-PAS will be the first radial BAO experiment to reach Stage IV.

Observatory



Teruel

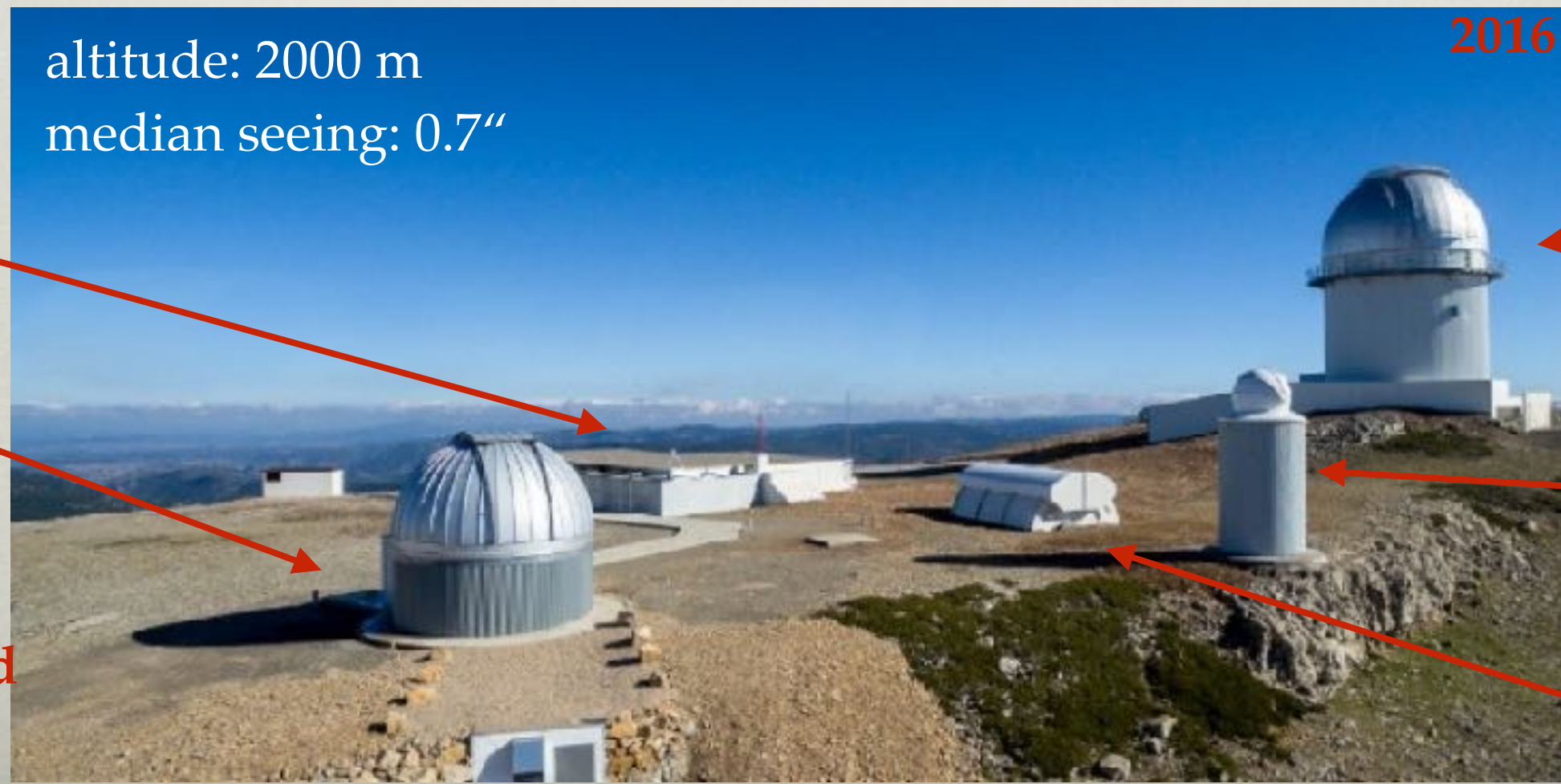


Very dry:
good for astronomy
(and jamón serrano)



El Pico del Buitre,
Sierra de Javalambre

Observatory







Very compact telescope

excellent étendue
(FOV · aperture)

Table 1. Main technical specifications

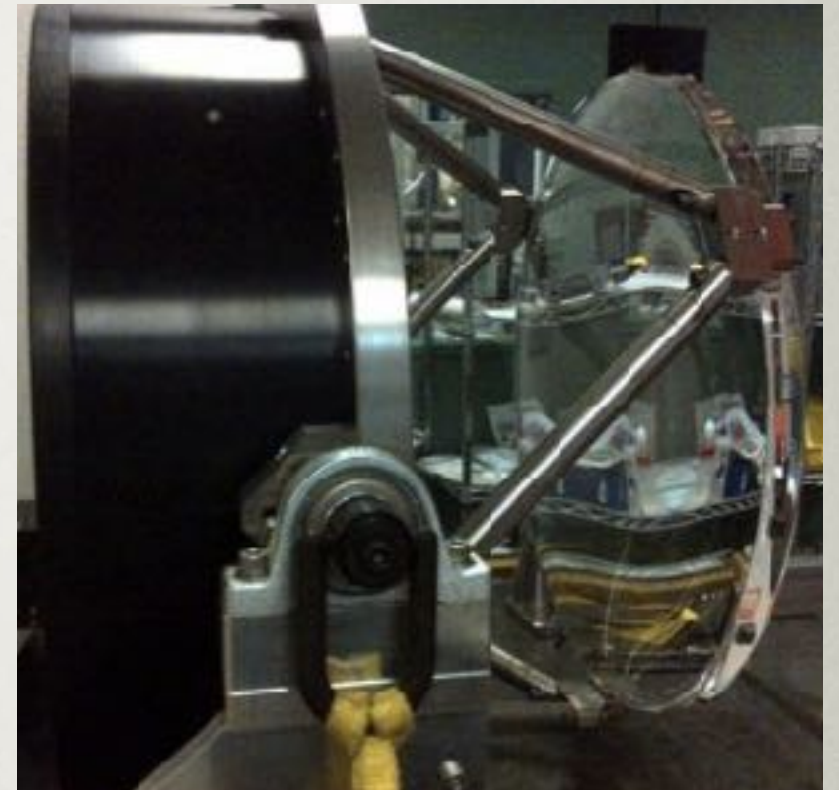
Optical configuration	Ritchey Chrétien li
M1 diameter	2.55m
FOV diameter	3deg (476mm phy
Effective collecting area	3.89 m ²
Etendue	26.5m ² deg ²
Focal length	9098mm
Plate scale	22.67 arcsec/mm
Mount	Altazimuthal
Focus	Cassegrain

weight: 45000 kg



Complex design

3-lens
aspherical field
corrector

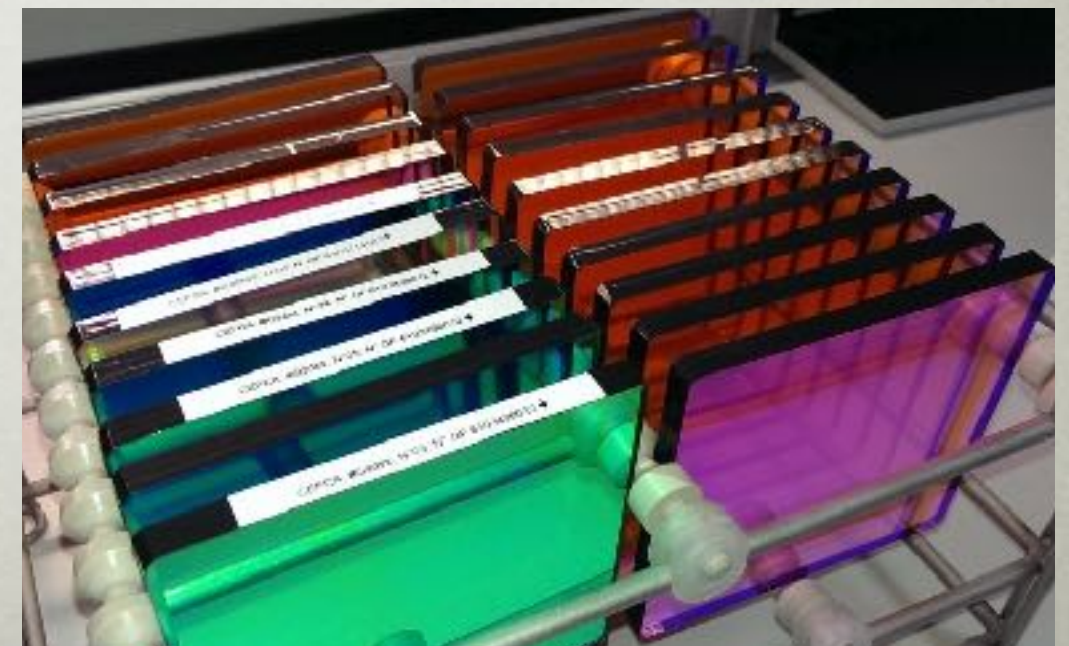


curved
secondary
mirror





JPCam



How to observe galaxies?

quasi-spectroscopy ($R \sim 50$) in every pixel

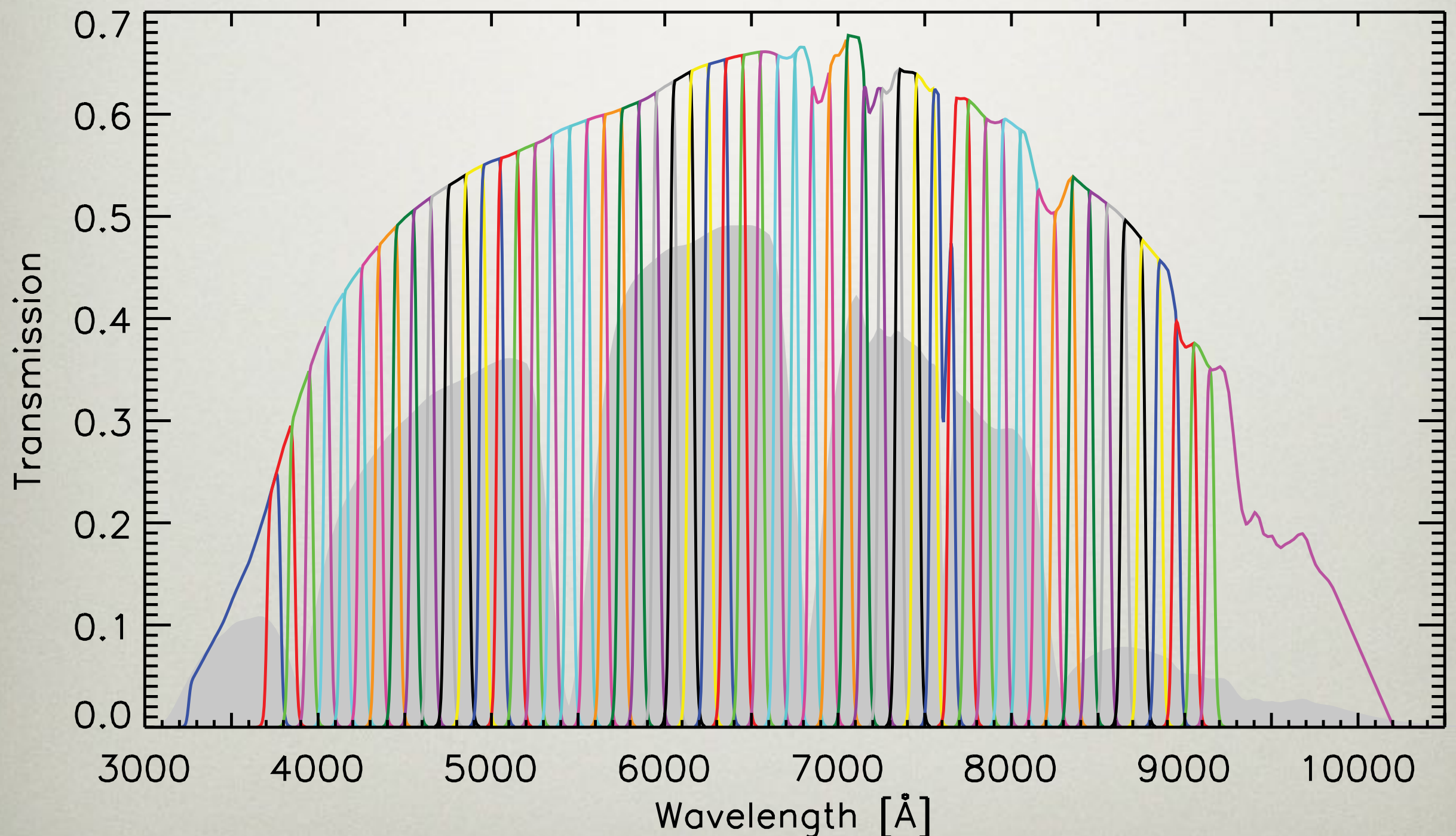


Figure 1. Transmission curves of the 54 narrow band and two medium-band overlapping J-PAS filters spanning the optical range (colour lines). The width of each narrow-band filter is ~ 145 Å and they are spaced by 100 Å. For comparison, the five SDSS filters are shown with grey-shaded shape.

Maintenance

coating vacuum
chamber for mirror
aluminization



dirty mirror

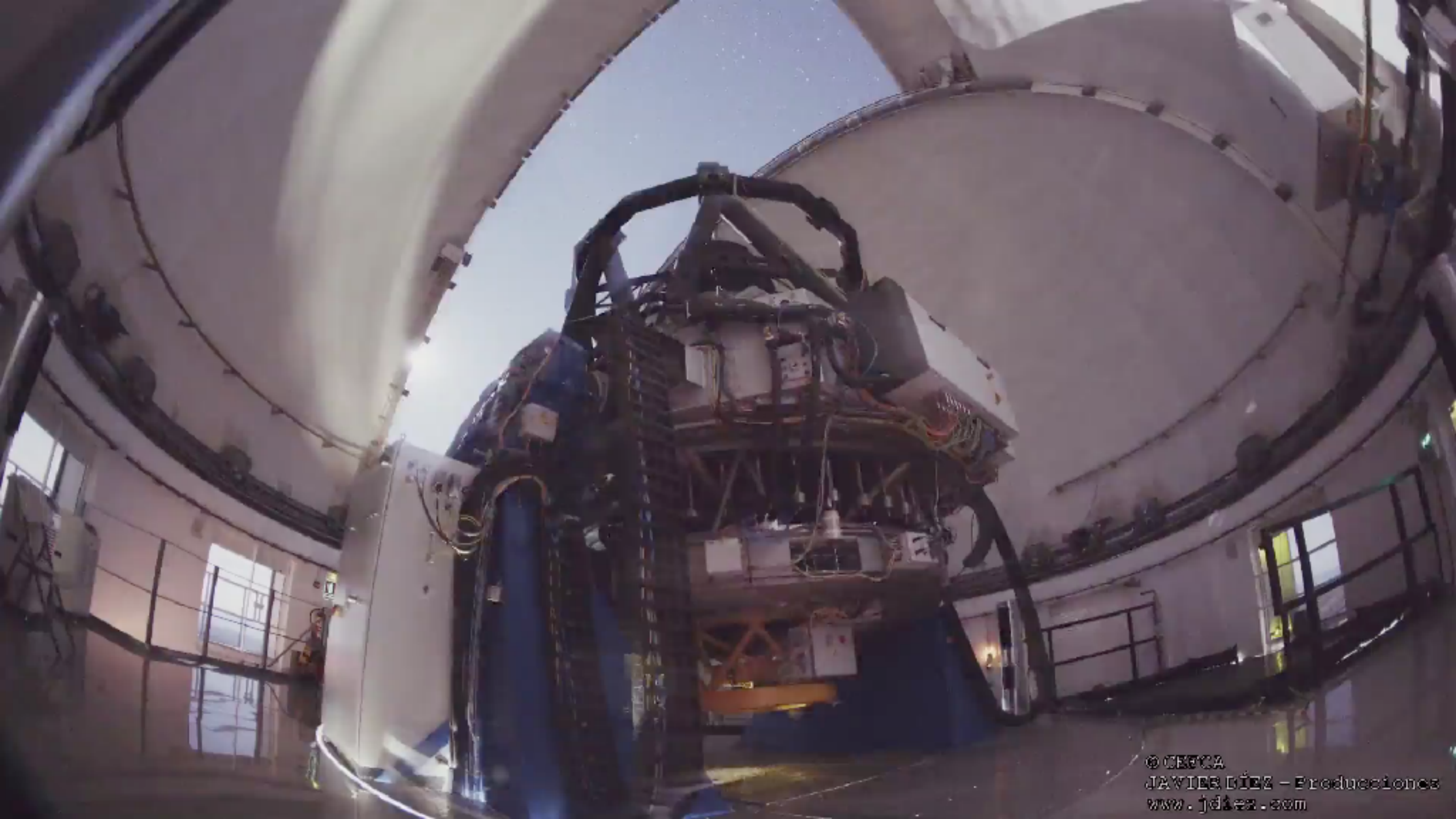


Control room and storage

3 control
rooms



Netapp cluster: 1.1 PB
Robotic tape library: 4PB
5000+MB / s bandwidth



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Congressos científicos cada 6 meses



Concluindo...

Estamos na **era de ouro da cosmologia**:

- grandes investimentos
- grandes colaborações mundiais
- grandes instrumentos científicos!

obrigado!