Cosmology

Master NPAC

Lesson 2 :
Homogeneity & Isotropy
Metrics, distances and curvature
Friedmann-Lemaître-Robertson-Walker metric
FRLW, GR and the Friedmann equations
Various definitions of the distance

Laurent Le Guillou

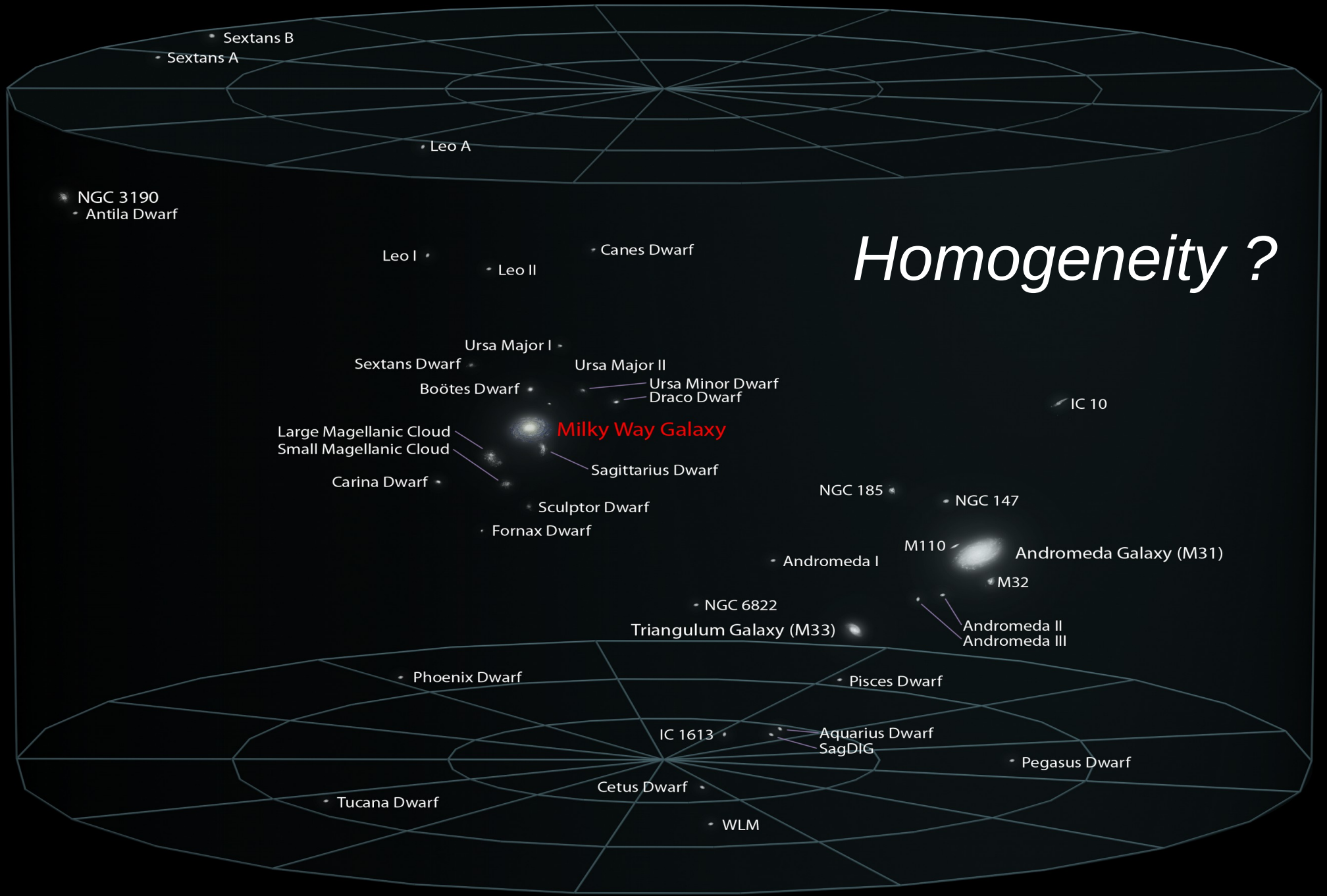
2016-11-23

Contents

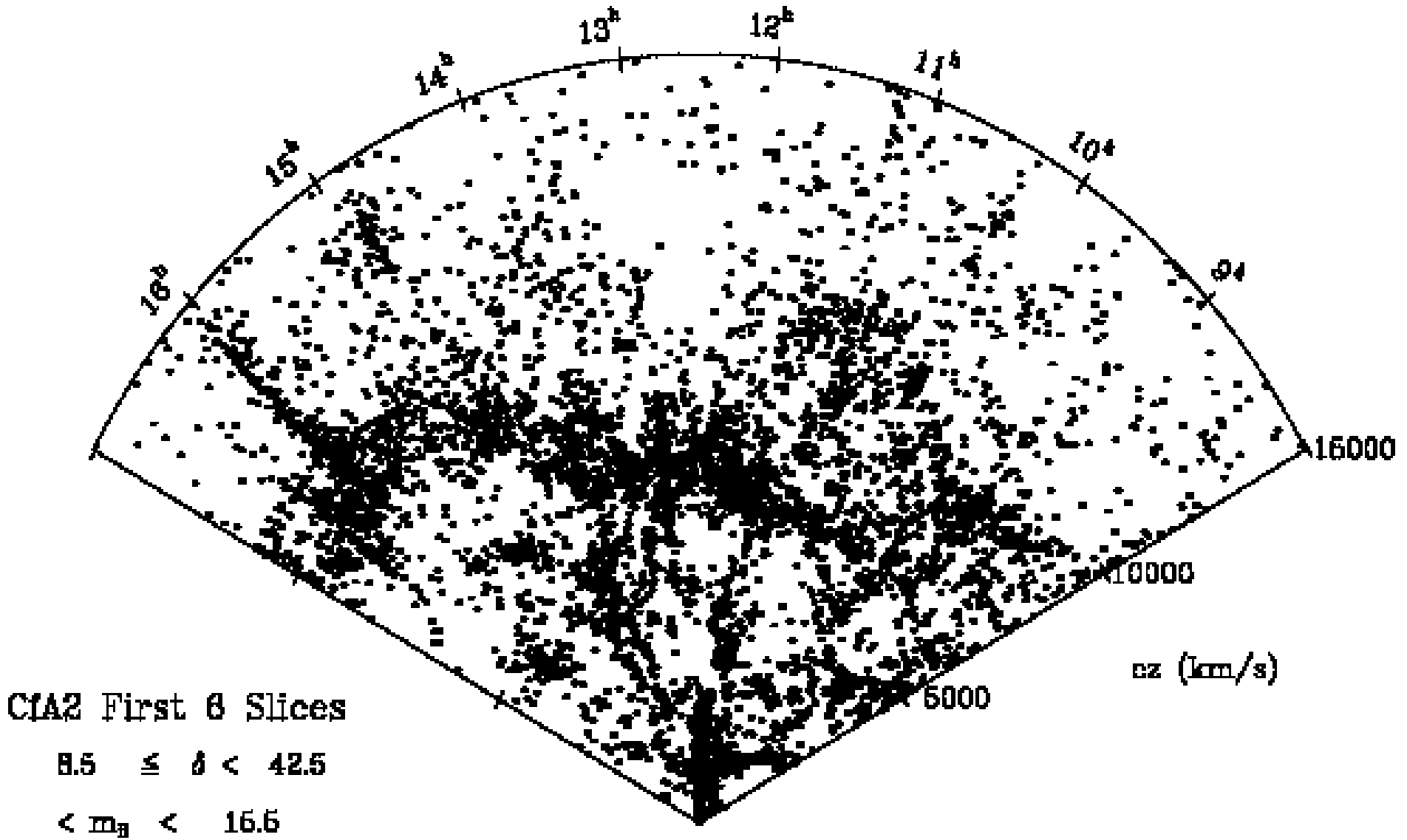
2.0

Homogeneity
Isotropy

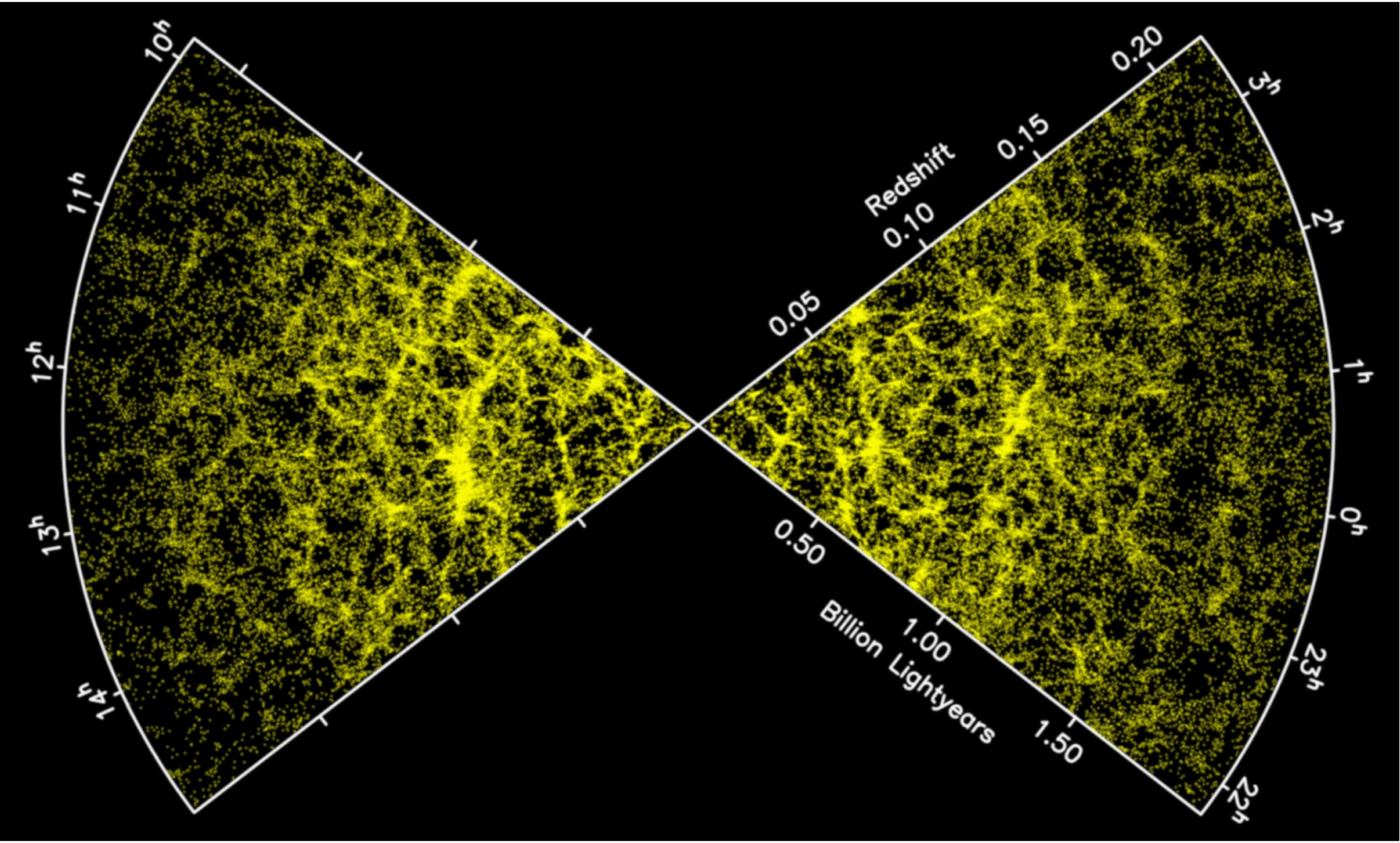
Local Galactic Group



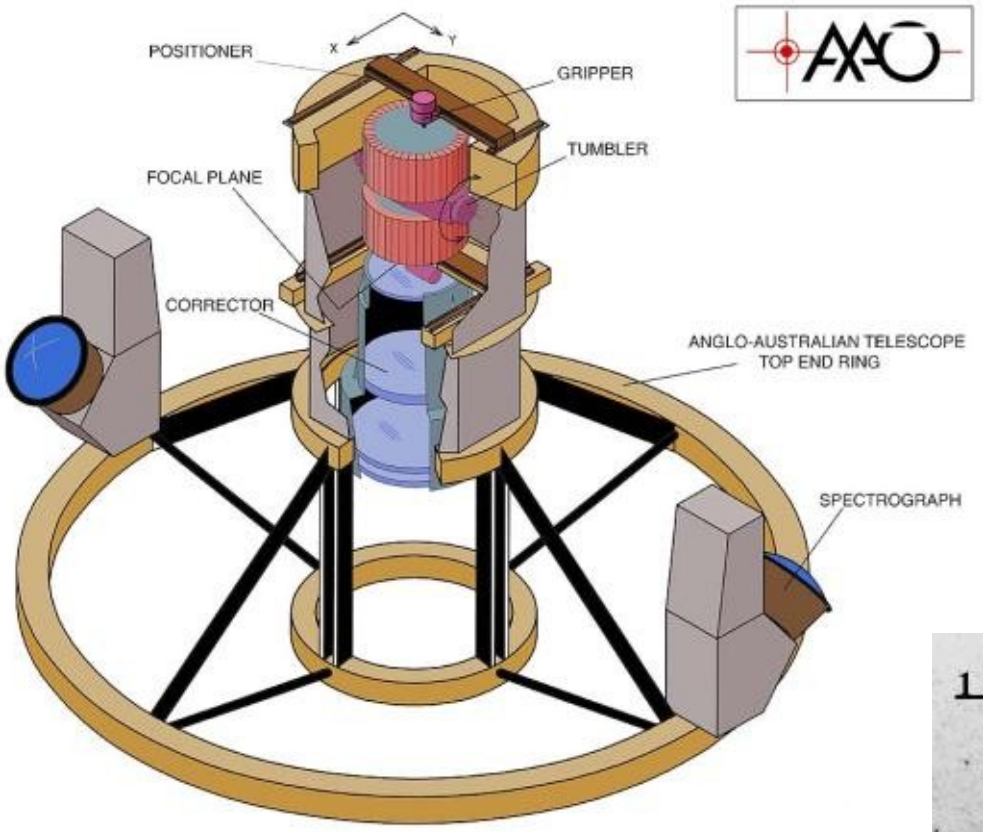
Homogeneity : redshift surveys

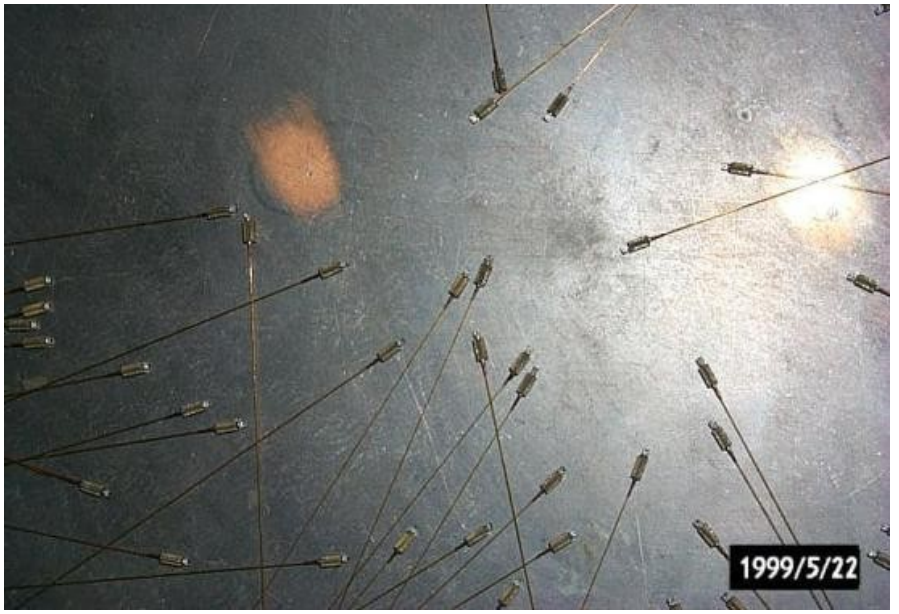


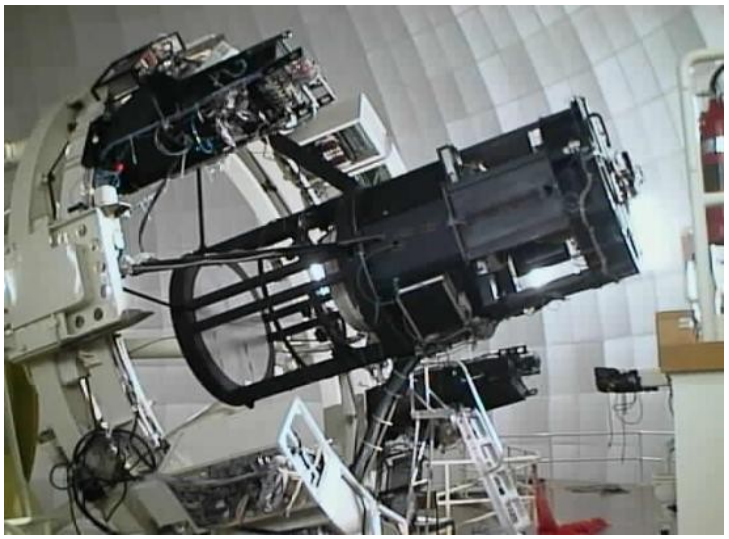
Homogeneity : redshift surveys

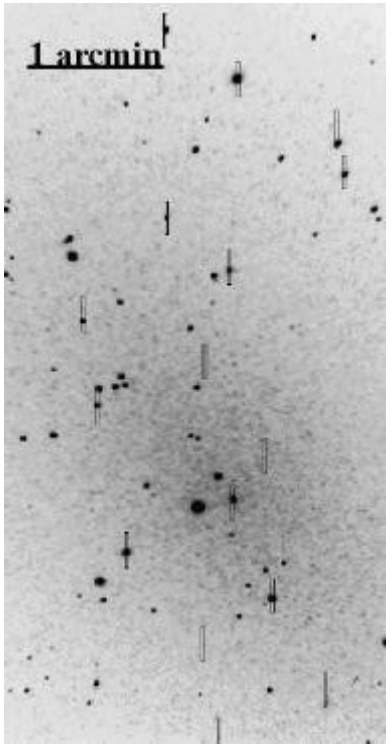


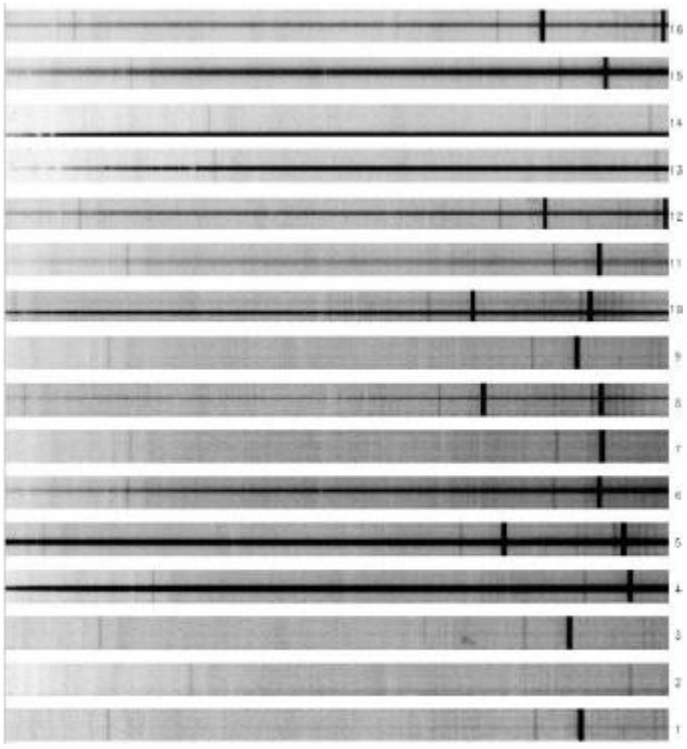
Homogeneity : redshift surveys (2dF, AAT)



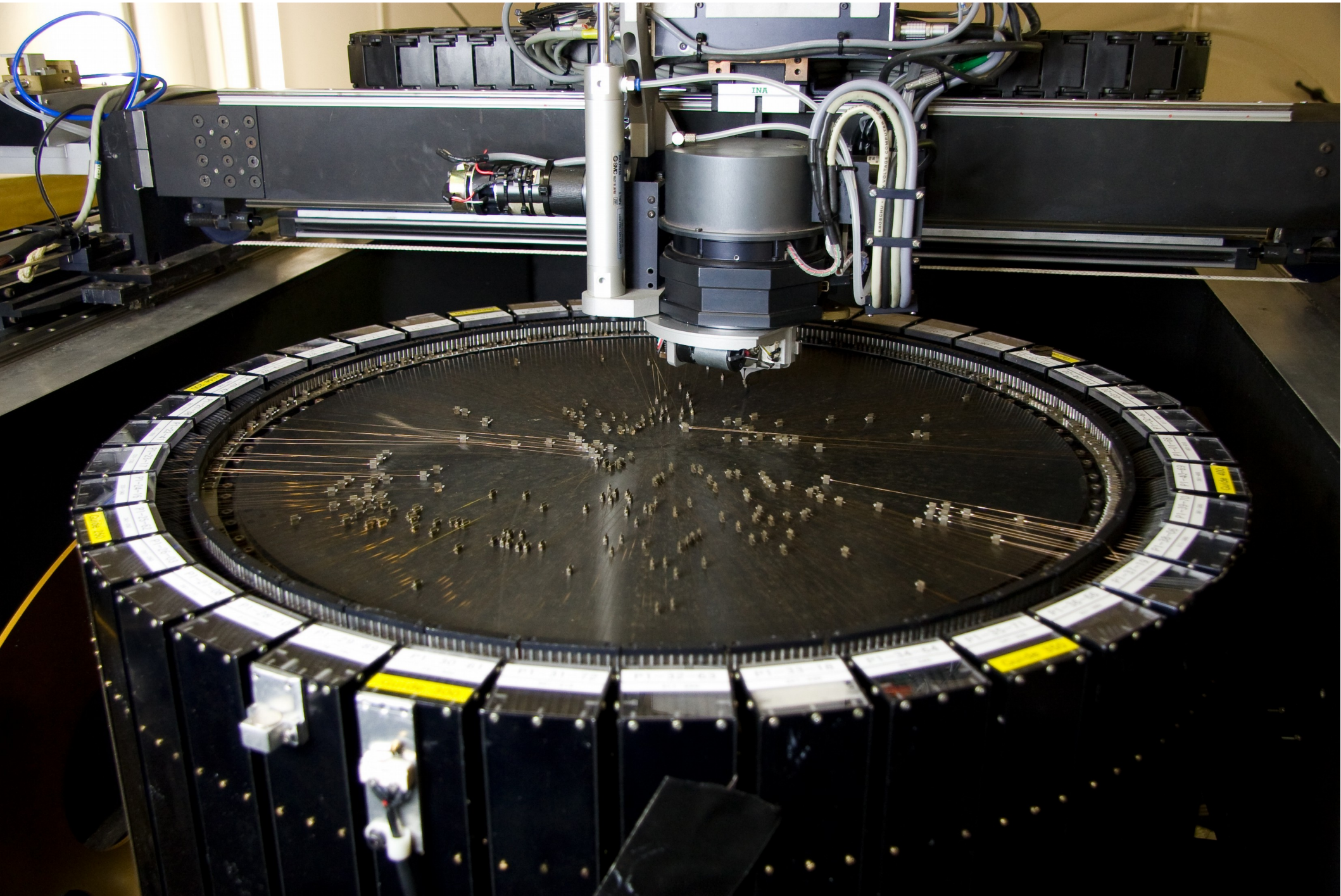




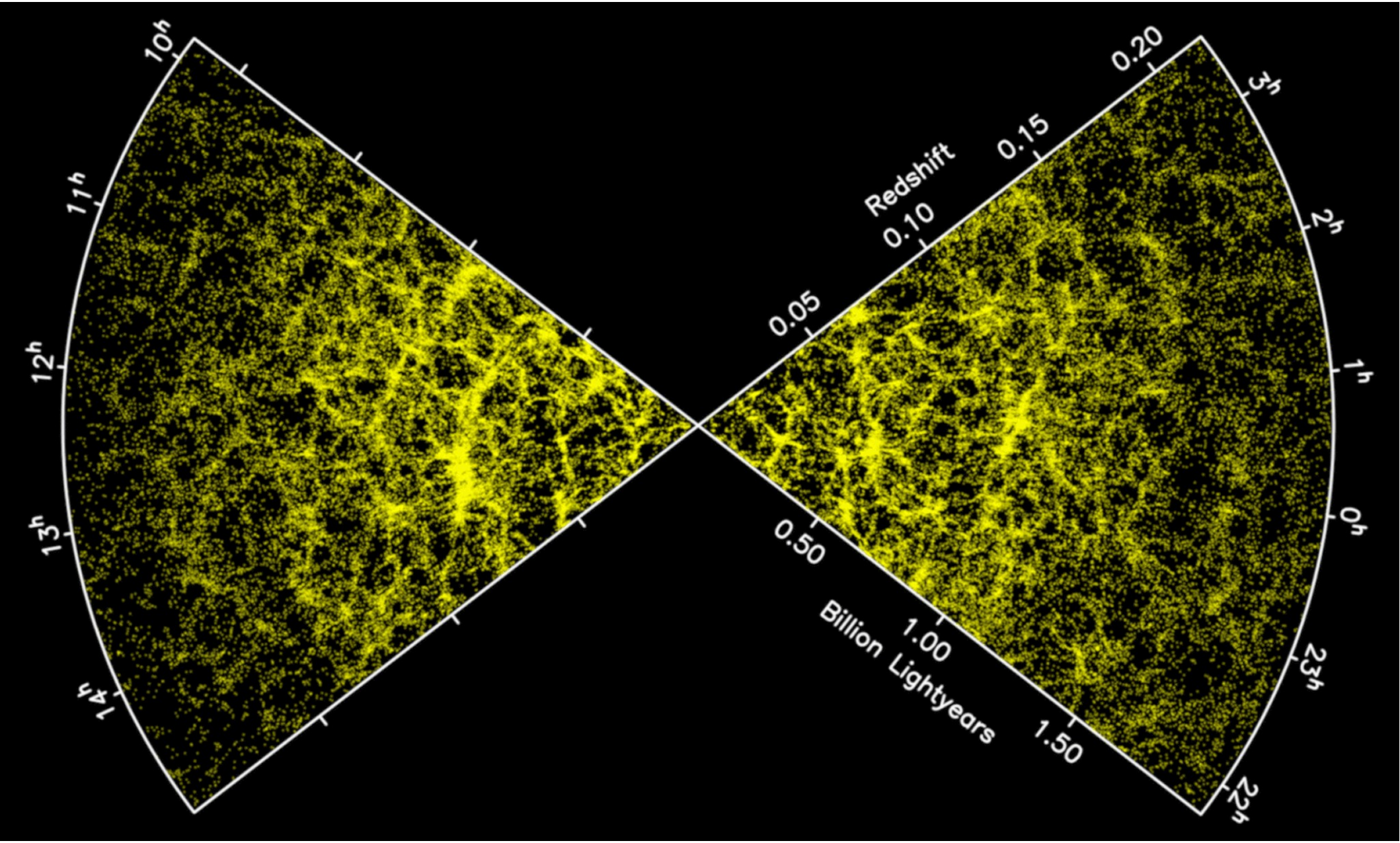




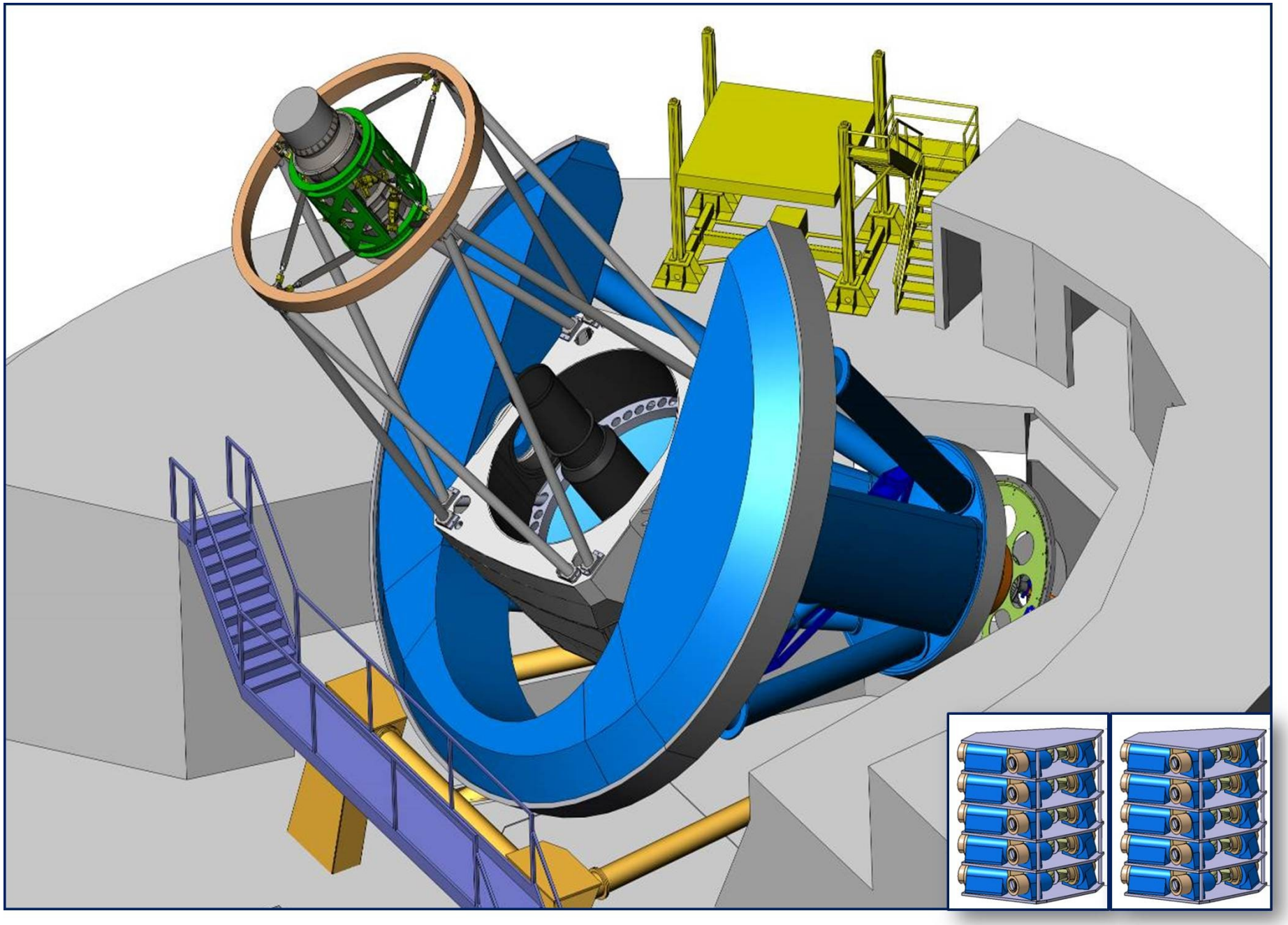
Homogeneity : redshift surveys (2dF, AAT)



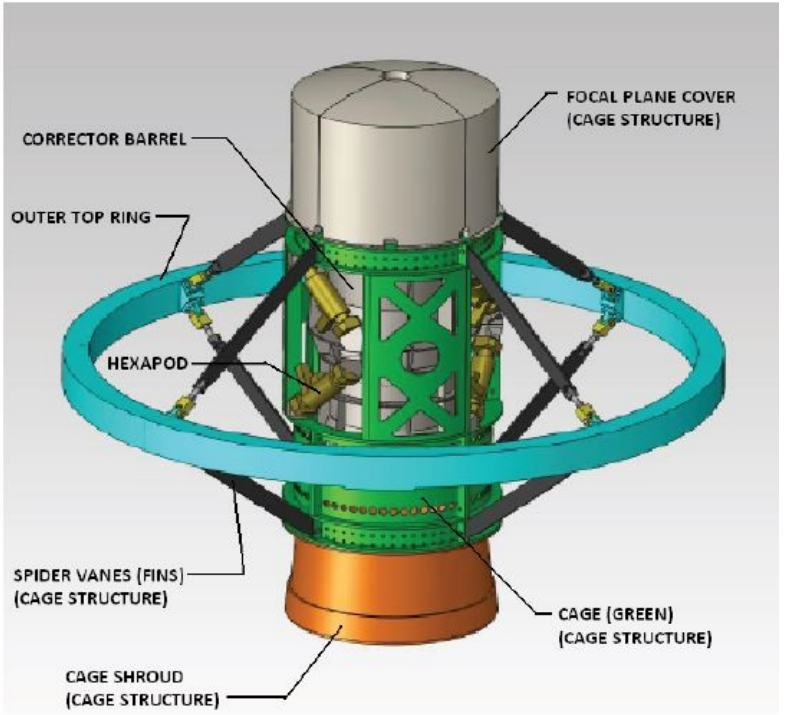
Homogeneity : redshift surveys

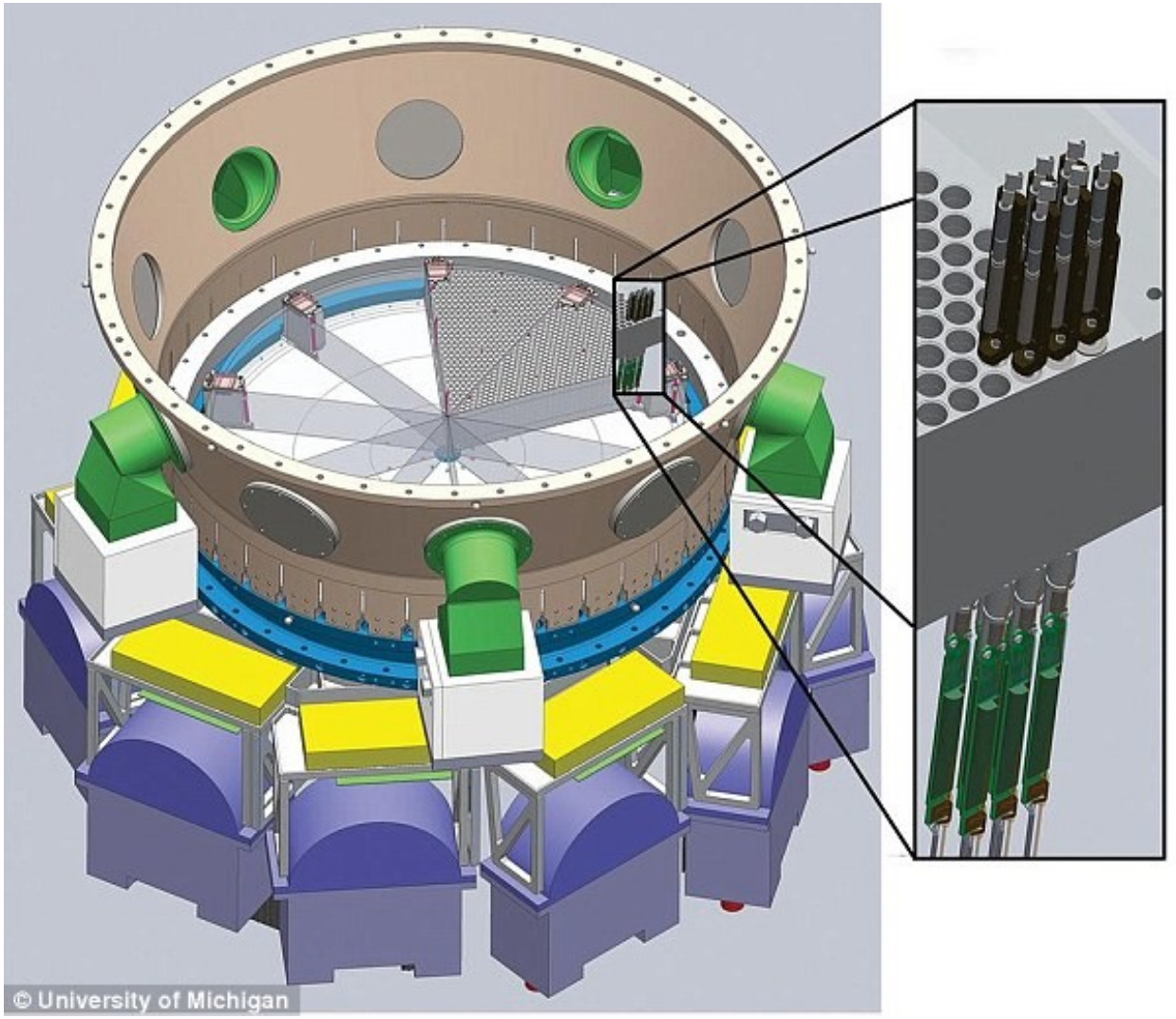


Next generation of redshit surveys : DESI

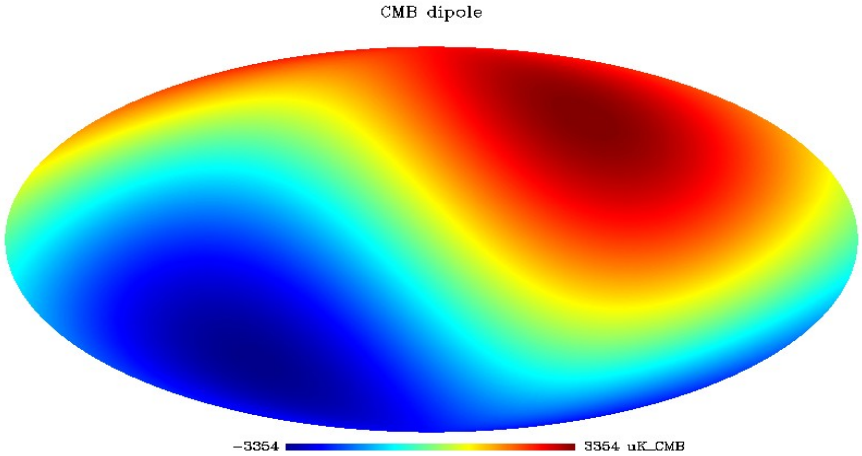


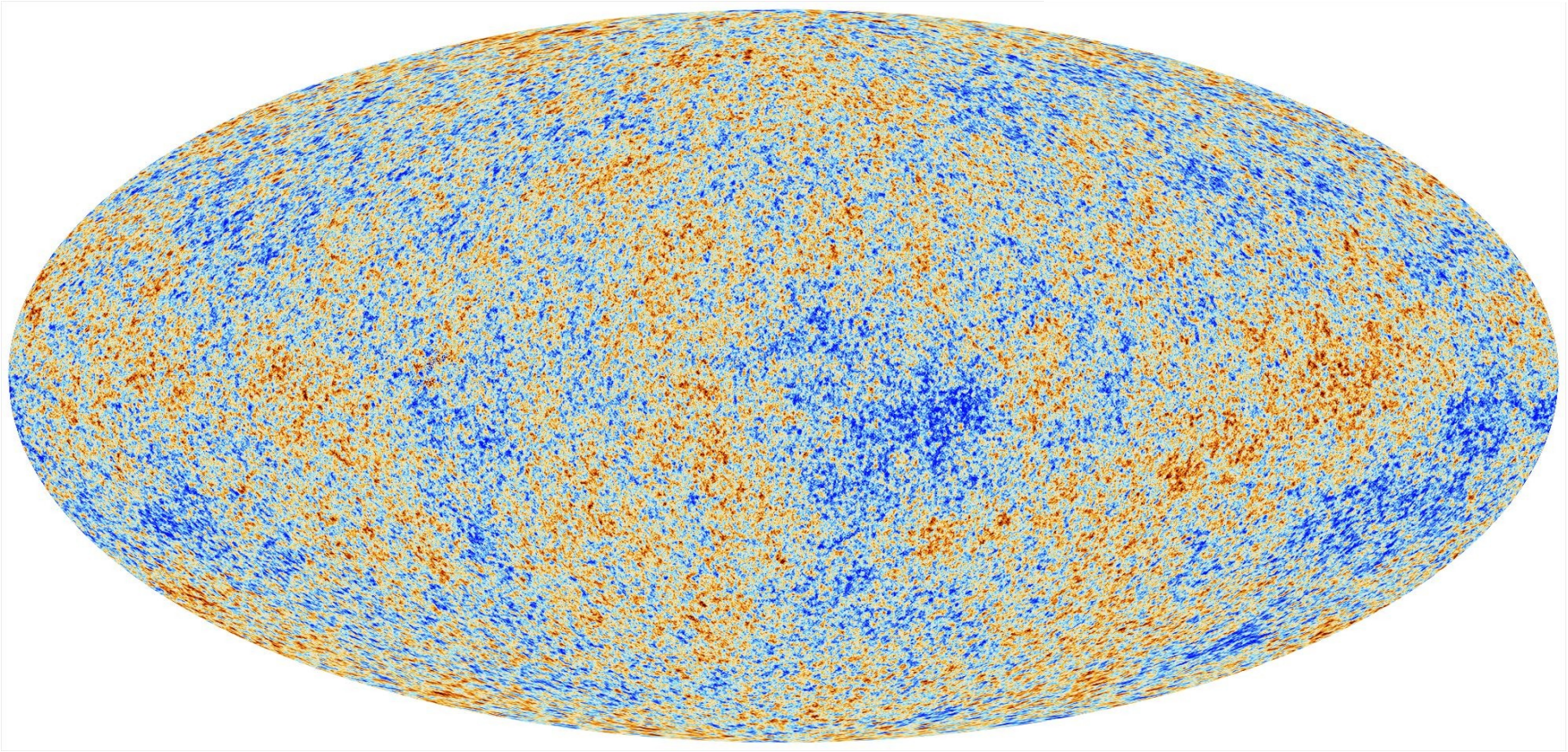
Next generation of redshit surveys : DESI





Isotropy : CMB





Anisotropies at the level of 10^{-5} (once dipole is removed)

It seems legit to describe the Universe :

As a *homogeneous perfect fluid*
without viscosity
evolving
in an *isotropic* and *uniform* space
(« copernician » view)

2.1

Metric, distance and curvature

Measuring the distance between two points may be a tricky business…

[chalkboard]

2.2

The Friedmann-Lemaître-Robertson-Walker (FLRW) metric

The most symetric metric in an evolving Universe

[chalkboard]

2.3

General Relativity

A (very fast) introduction

[chalkboard]


$R_{\mu\nu} - \frac{1}{2} g_{\mu\nu} R = \frac{8\pi G}{c^4} T_{\mu\nu}$
SAM EINSTEIN
HORROR

2.4

The FLRW metric and the Friedmann equations

[chalkboard]

The many concepts of « distance »

There are many ways to measure cosmological distances, and they all produce different results…

[chalkboard]