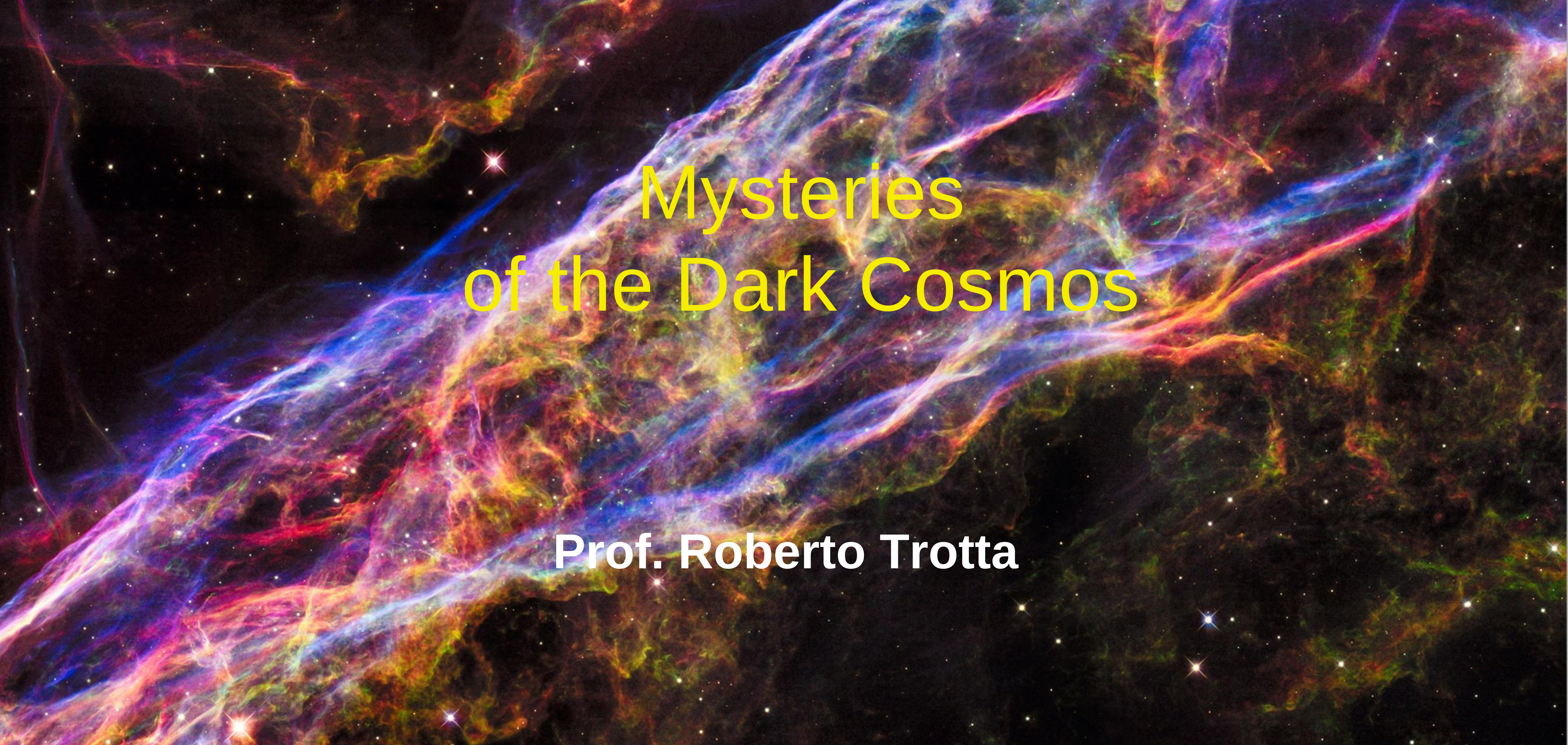


A vibrant, multi-colored visualization of the cosmic web, showing intricate filaments of gas and dark matter stretching across a dark, star-filled universe. The colors range from deep blues and purples to bright yellows and oranges, highlighting different regions and structures.

Mysteries of the Dark Cosmos

Prof. Roberto Trotta

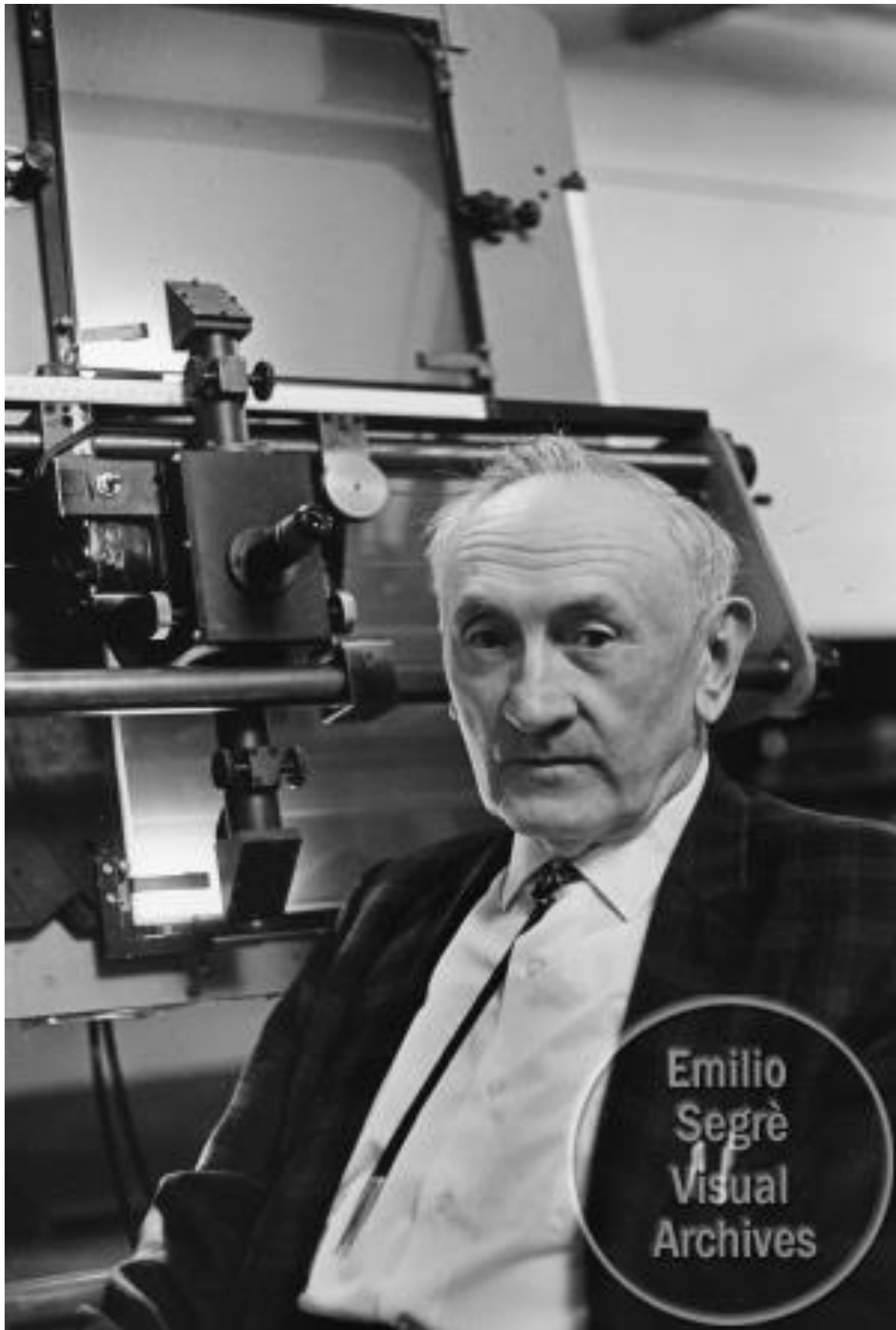
**Imperial College
London**

www.robertotrotta.com

 [@R_Trotta](https://twitter.com/R_Trotta)



South Downs National Park: A Dark Sky Reserve. Credit: Chris Nesbit



Courtesy AIP Emilio Segrè Visual Archives

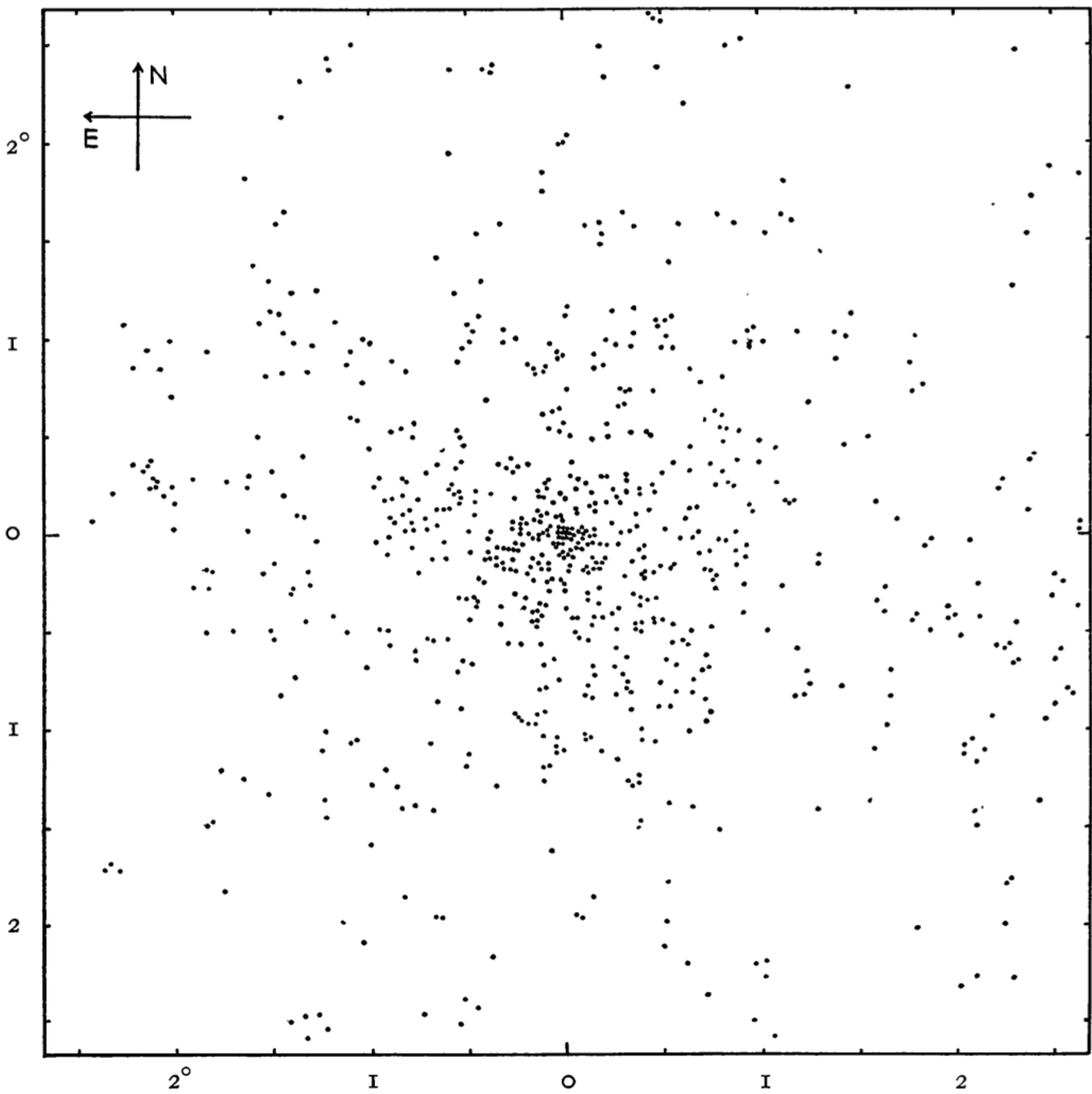


FIG. 3.—The Coma cluster of nebulae

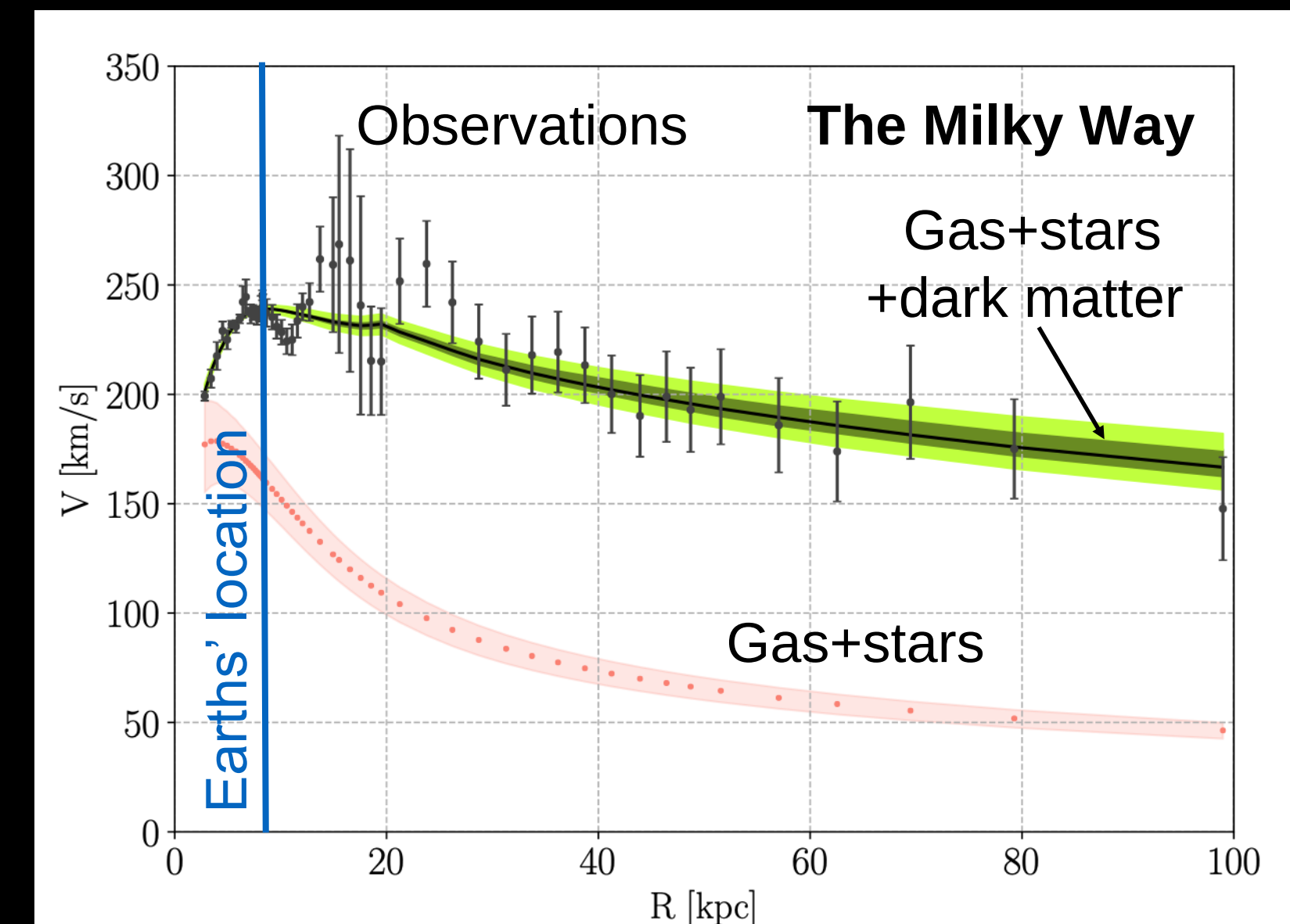
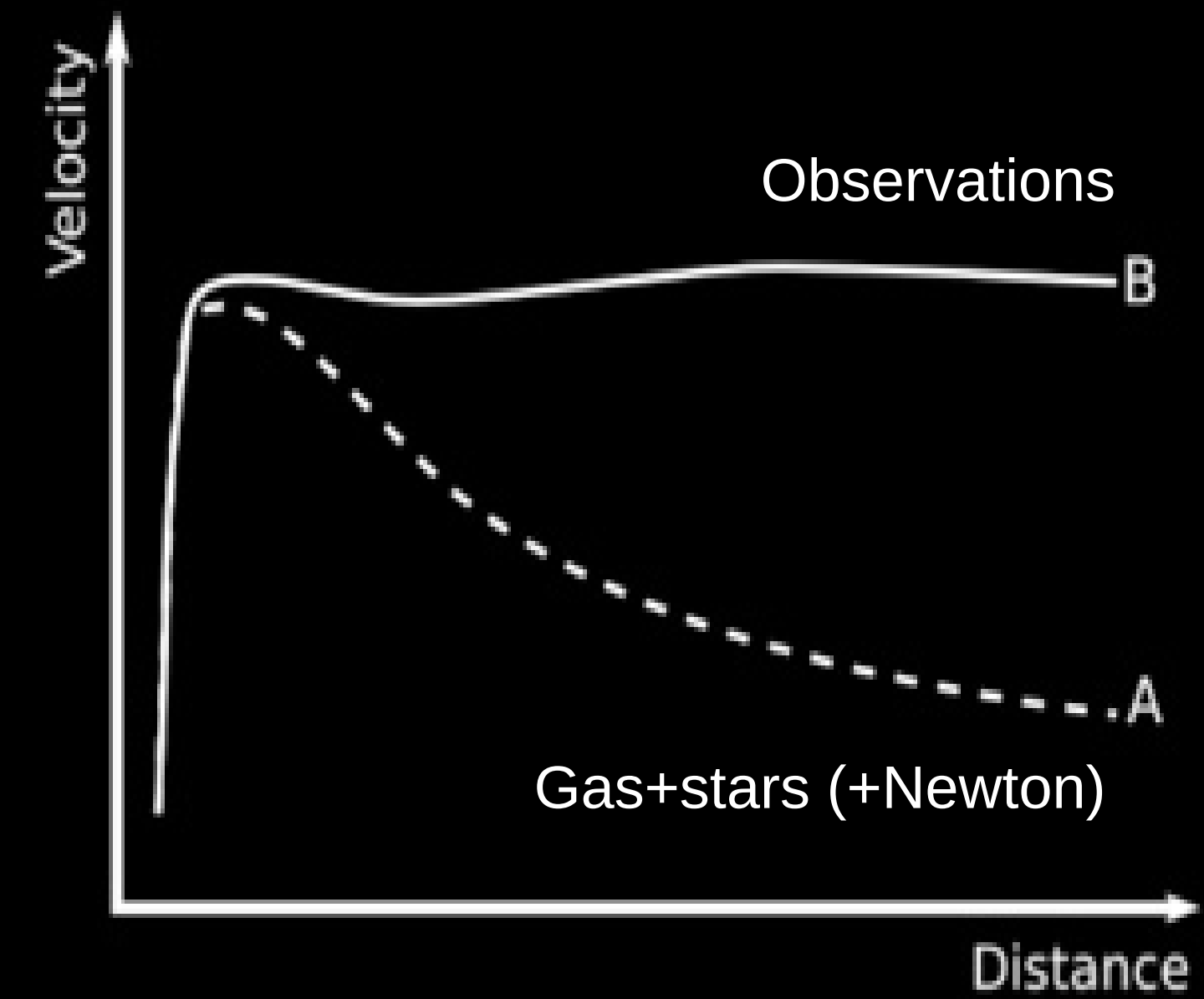
Zwicky (1937)



Credit: D. Rowe/NASA



Courtesy AIP Emilio Segrè Visual Archives

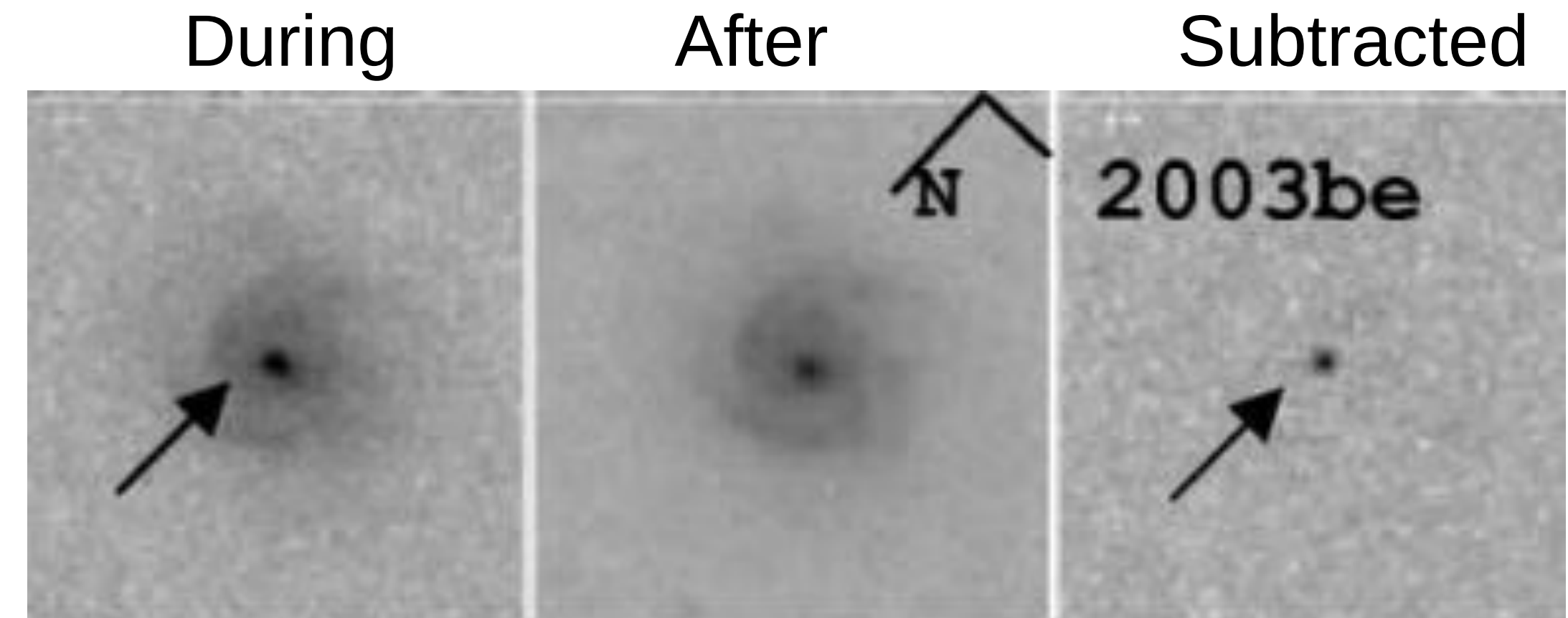


Karukes, RT et al (2019)

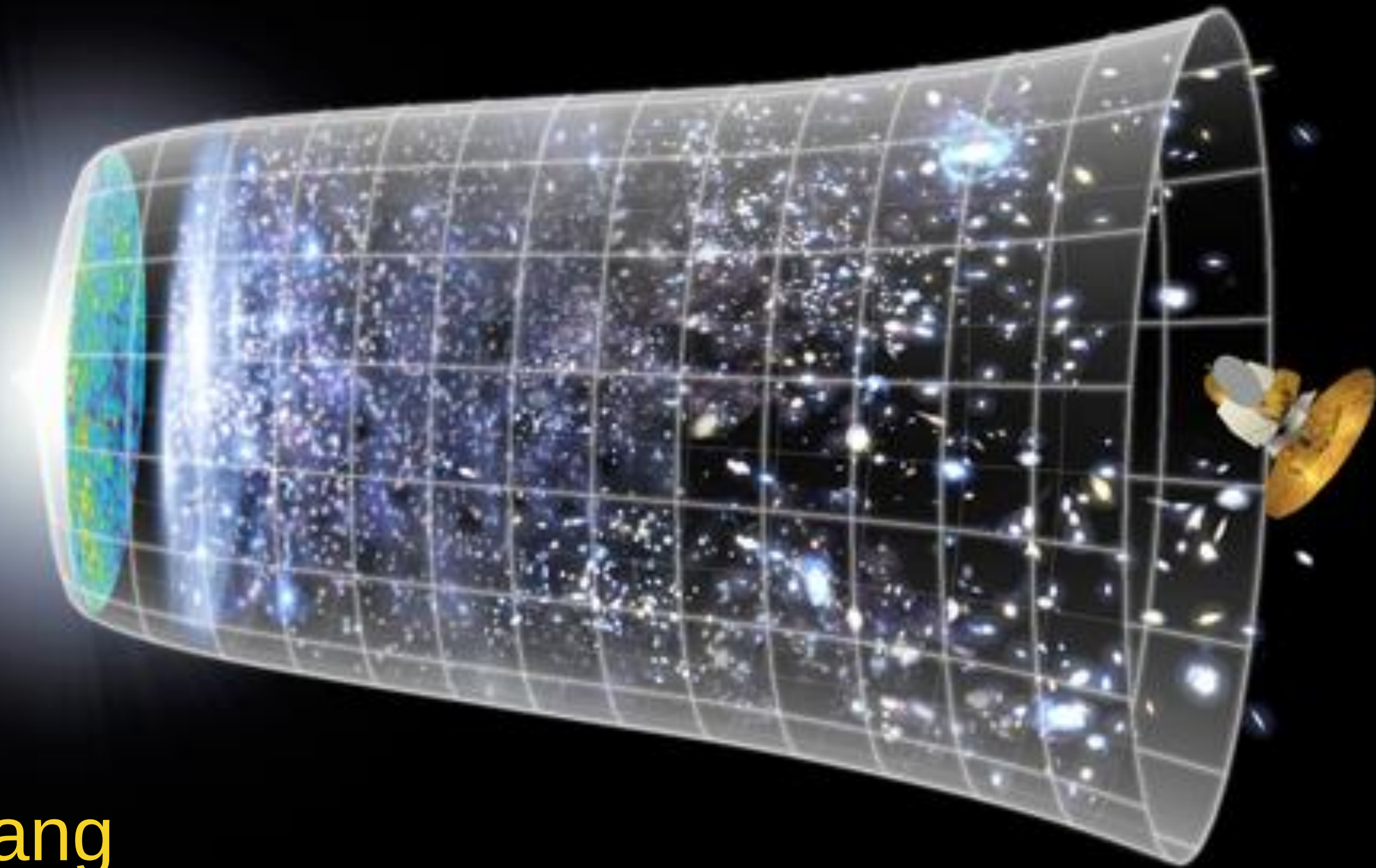
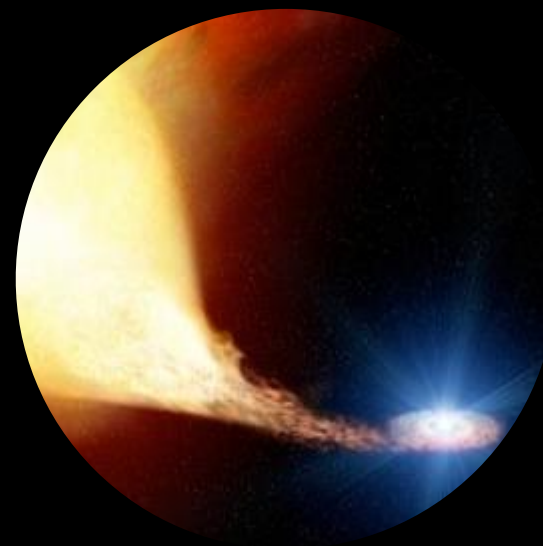
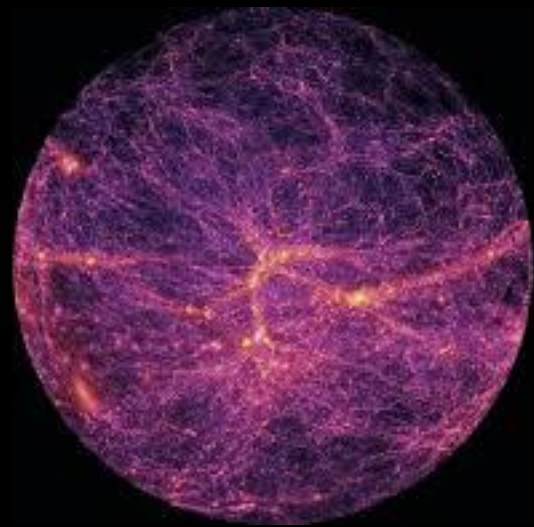
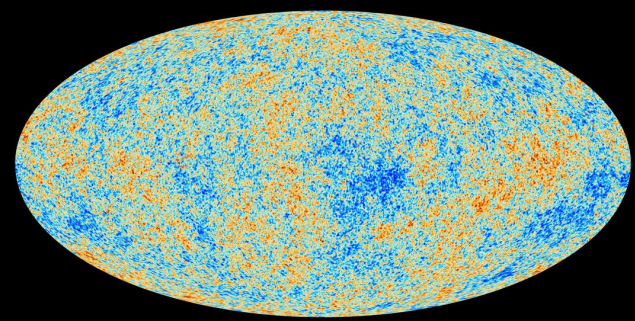
Artist's impression



Supernovae Type Ia: Observations



Riess et al, ApJ, 607:665-687 (2004)



5% Normal Matter



25% Dark Matter

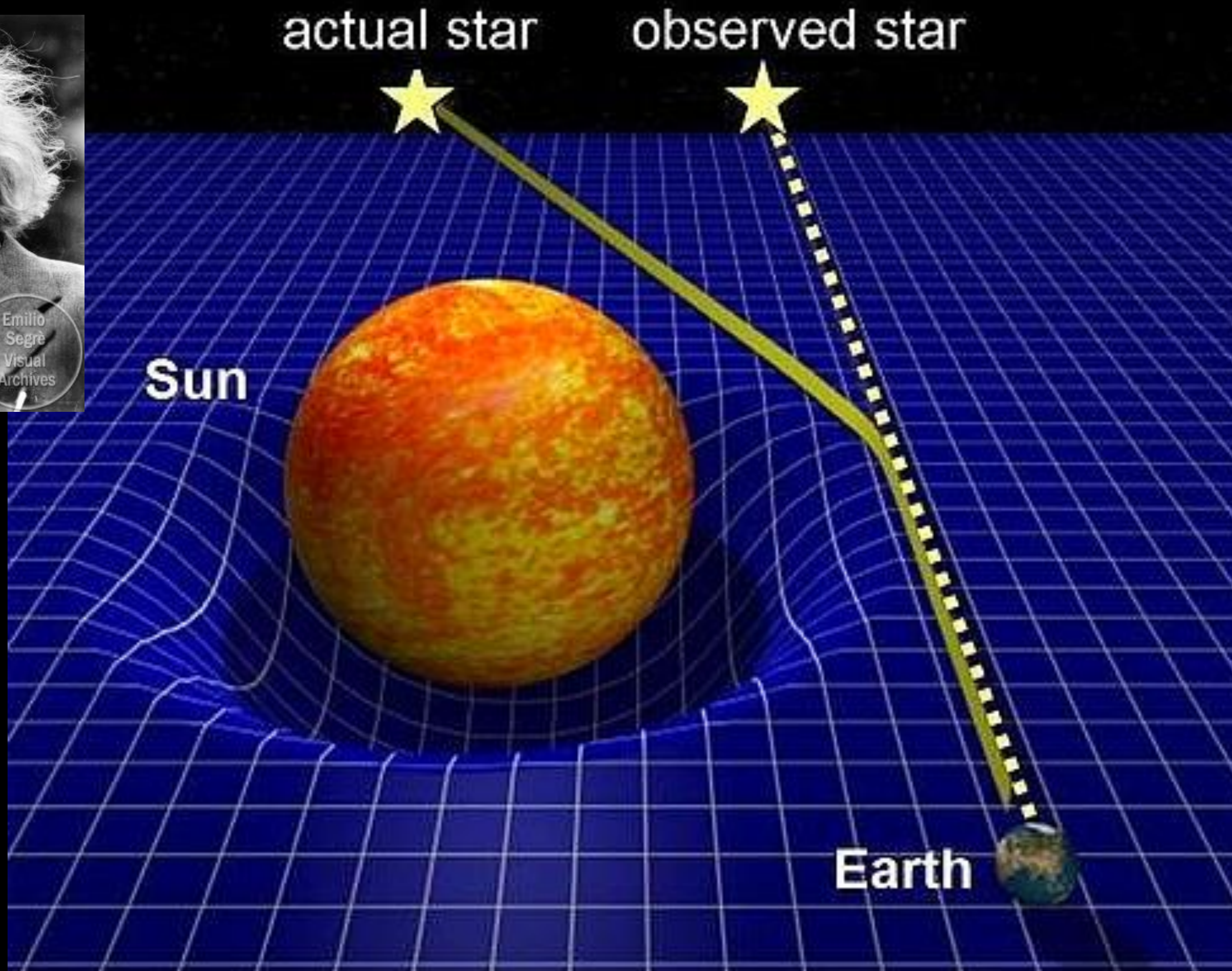
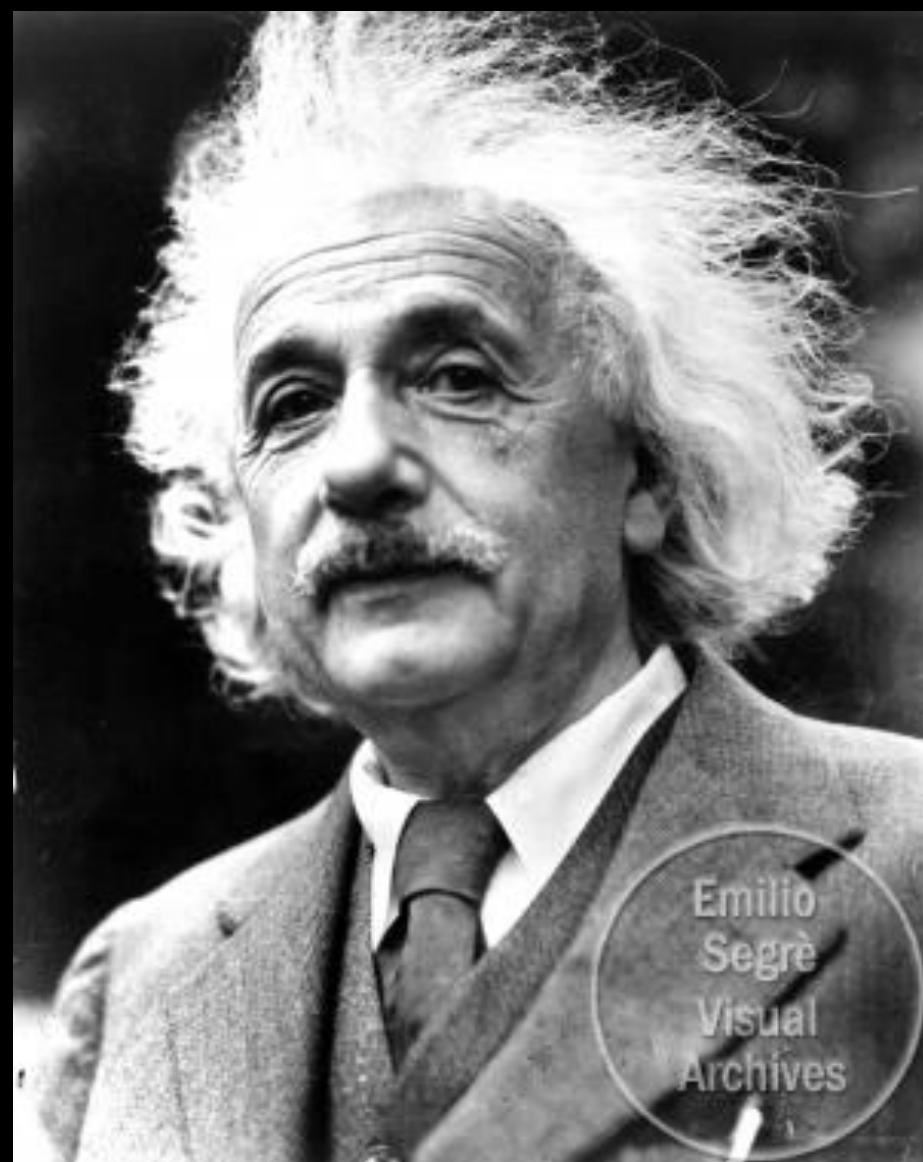


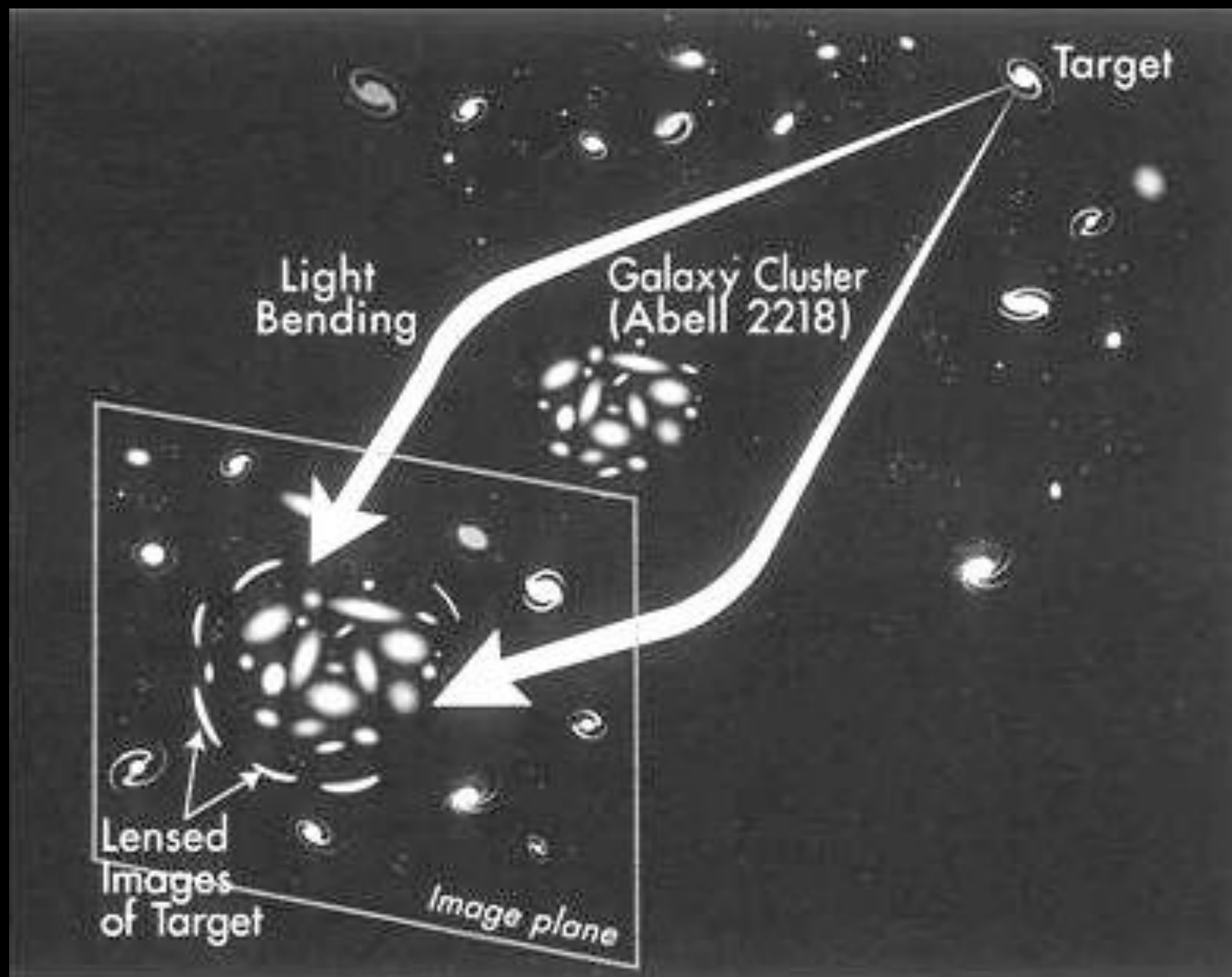
70% Dark Energy

Big Bang
 $t=0$

Today
13.8 Bn years

time

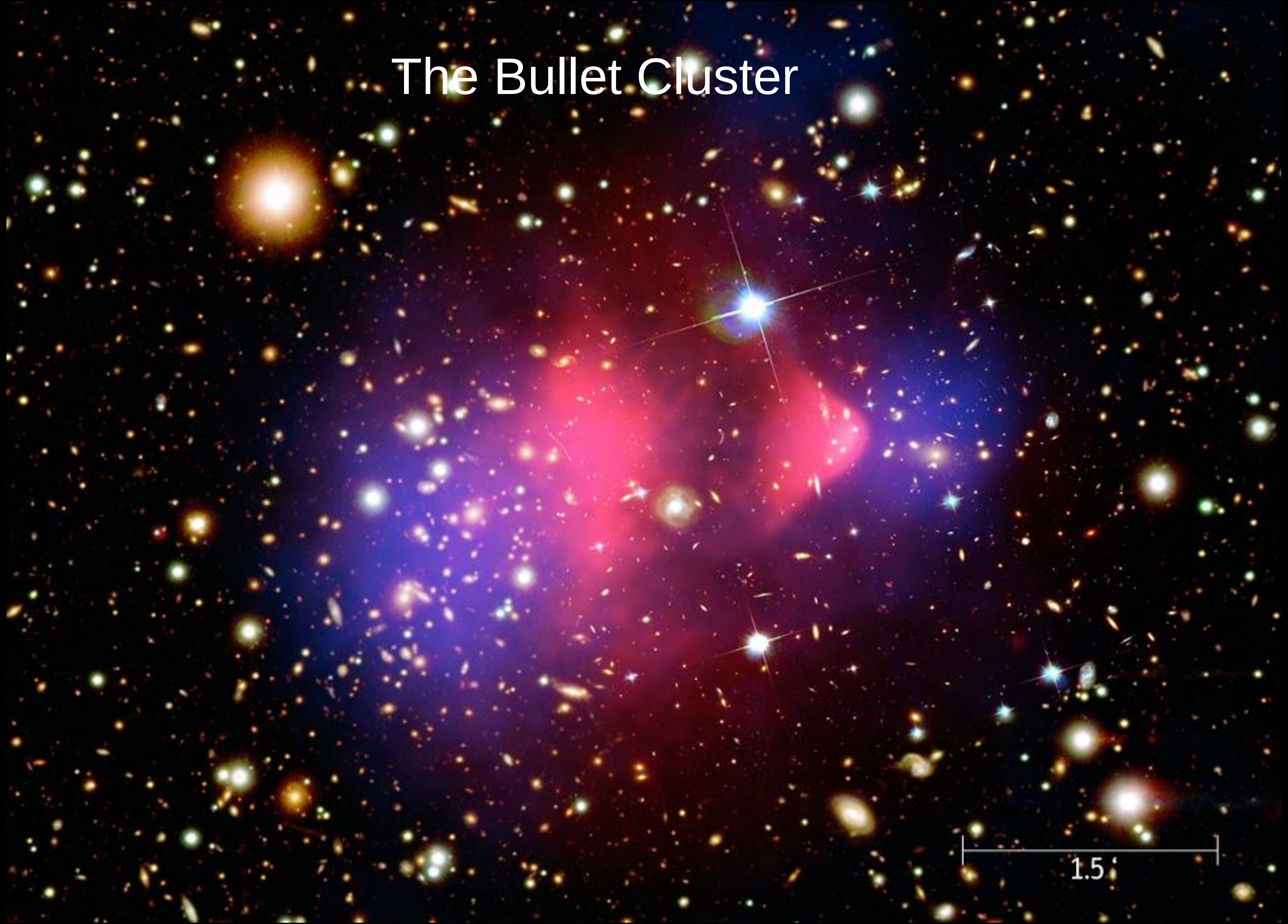




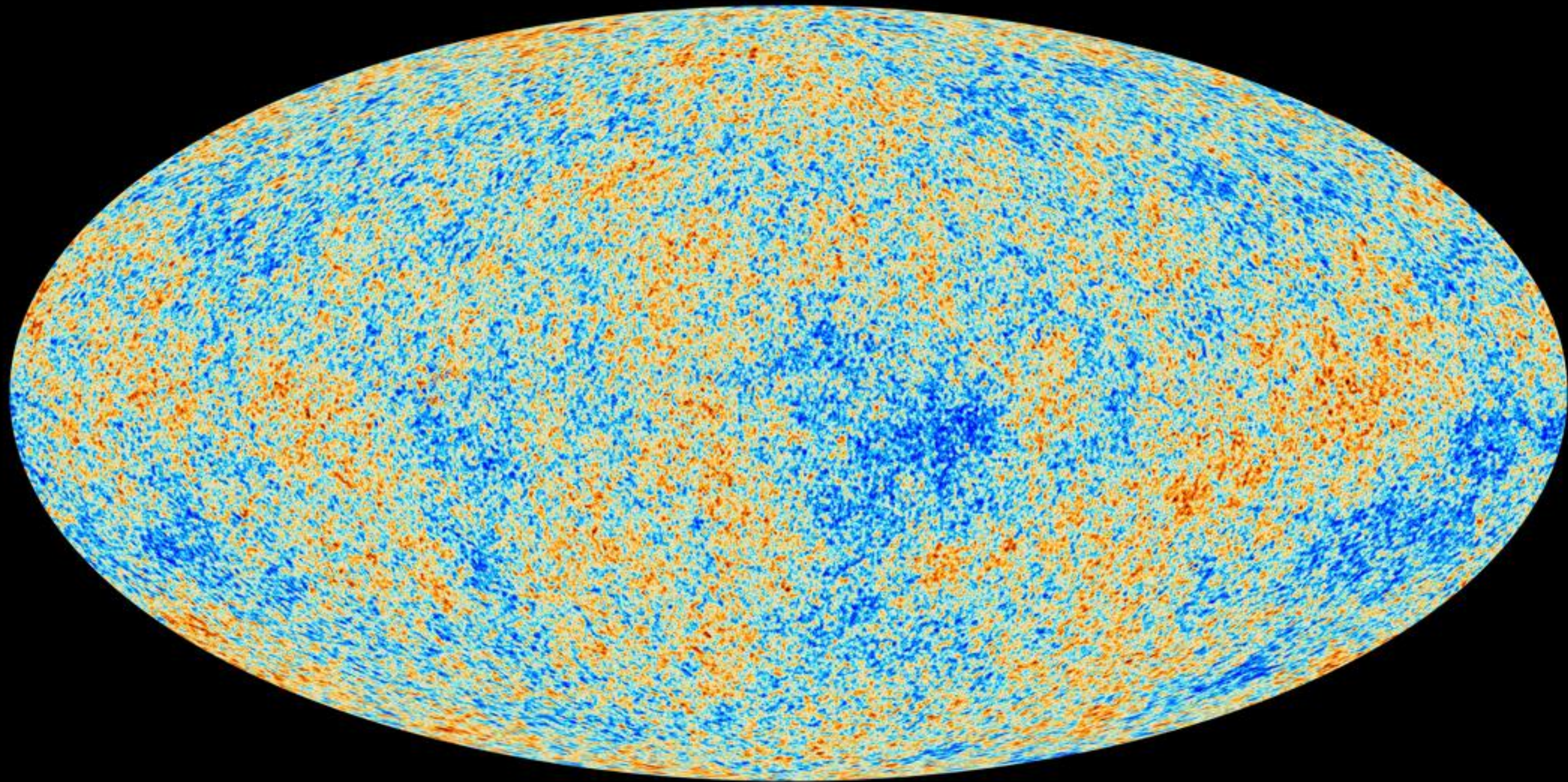
The Abell 2218 Galaxy Cluster

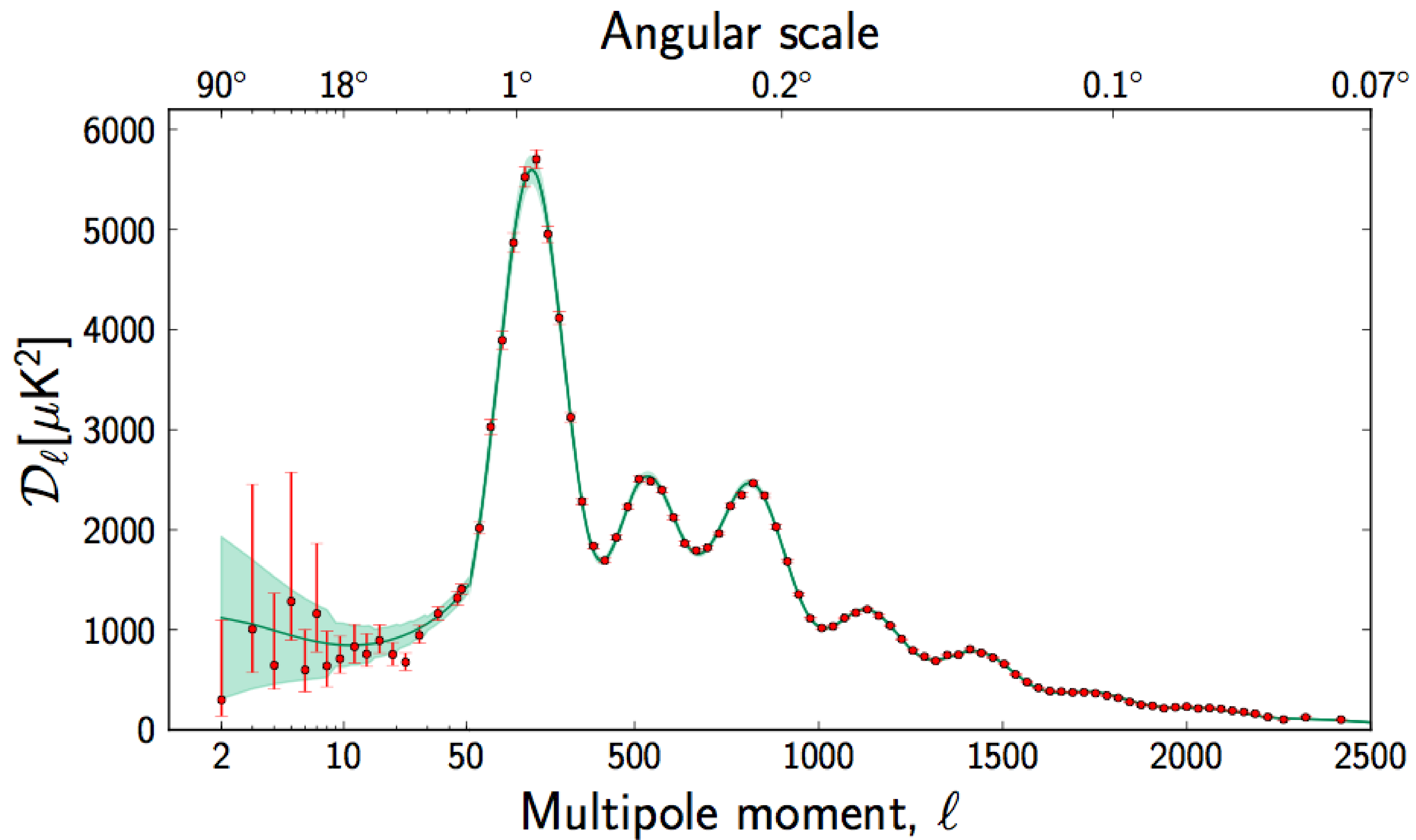


The Bullet Cluster



The Relic Radiation from the Big Bang

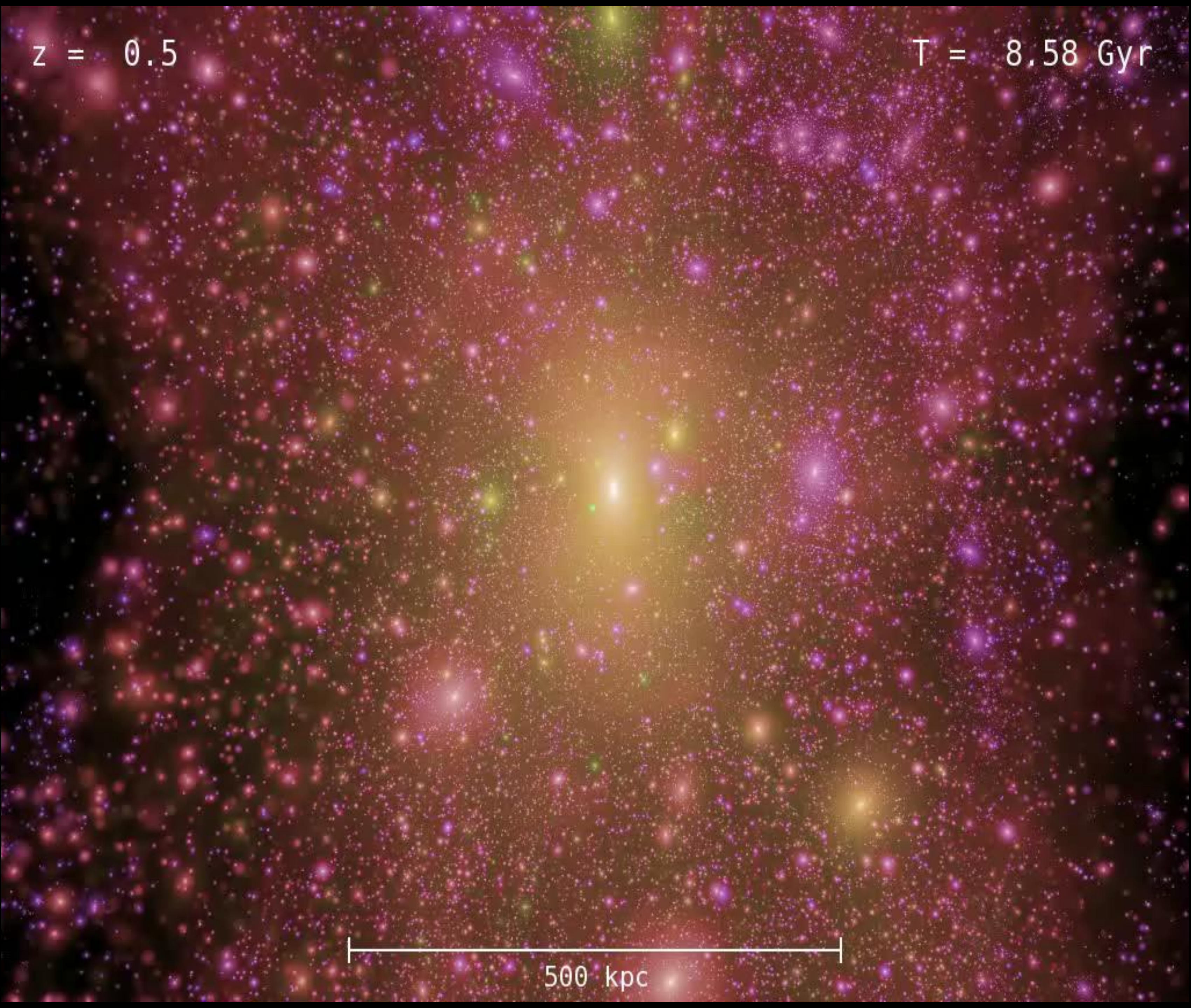




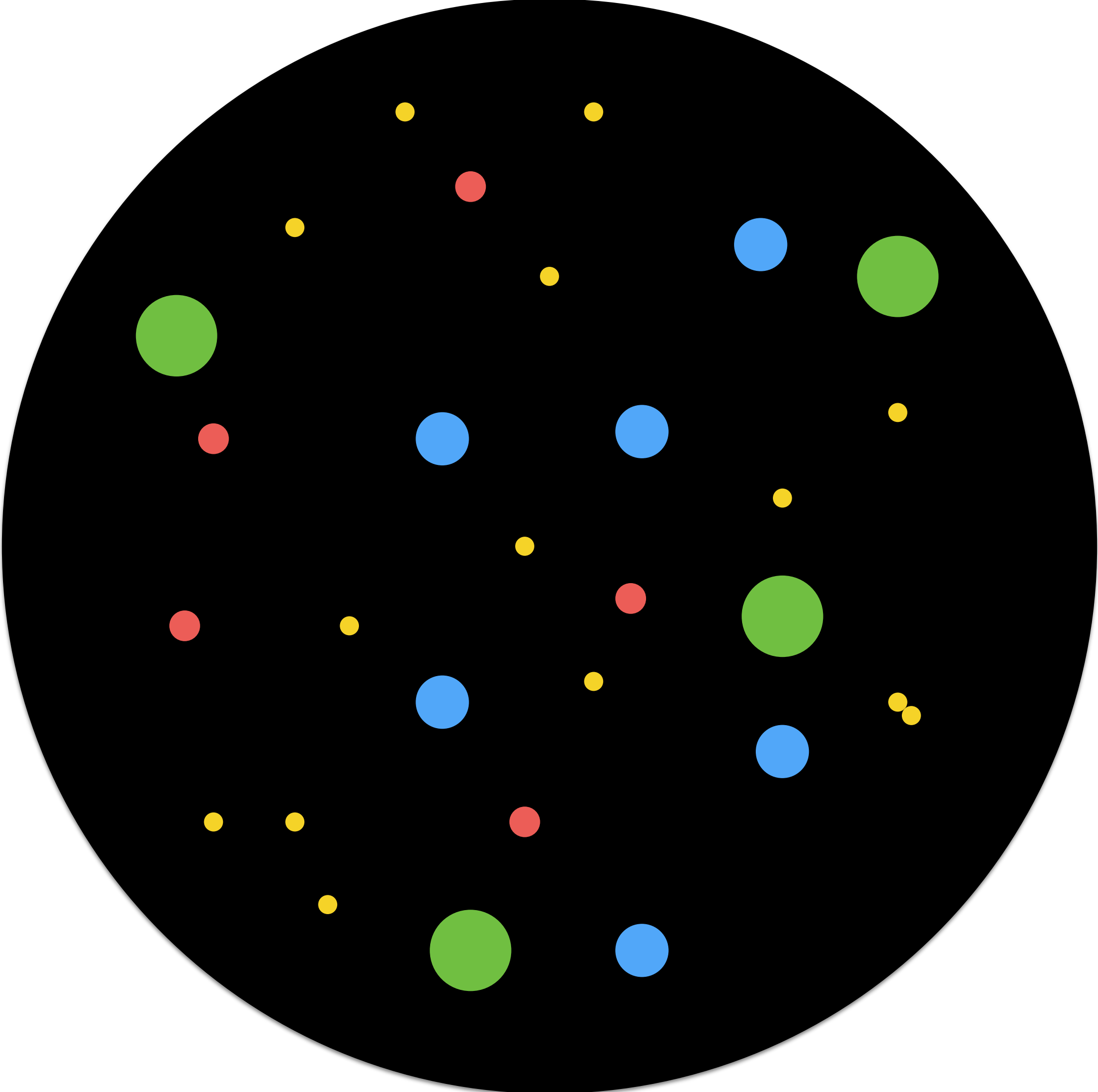
$z = 0.5$

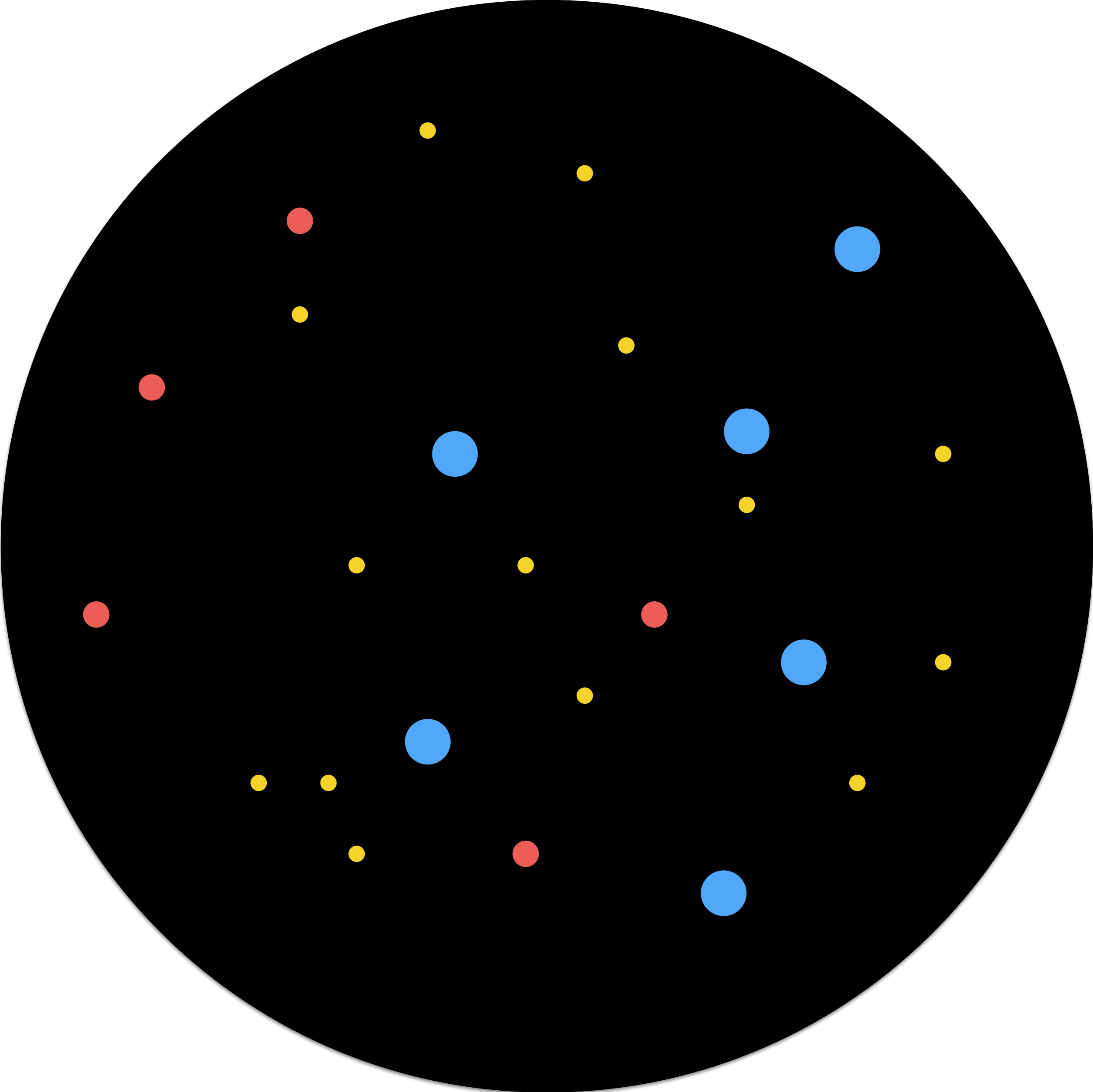
$T = 8.58 \text{ Gyr}$

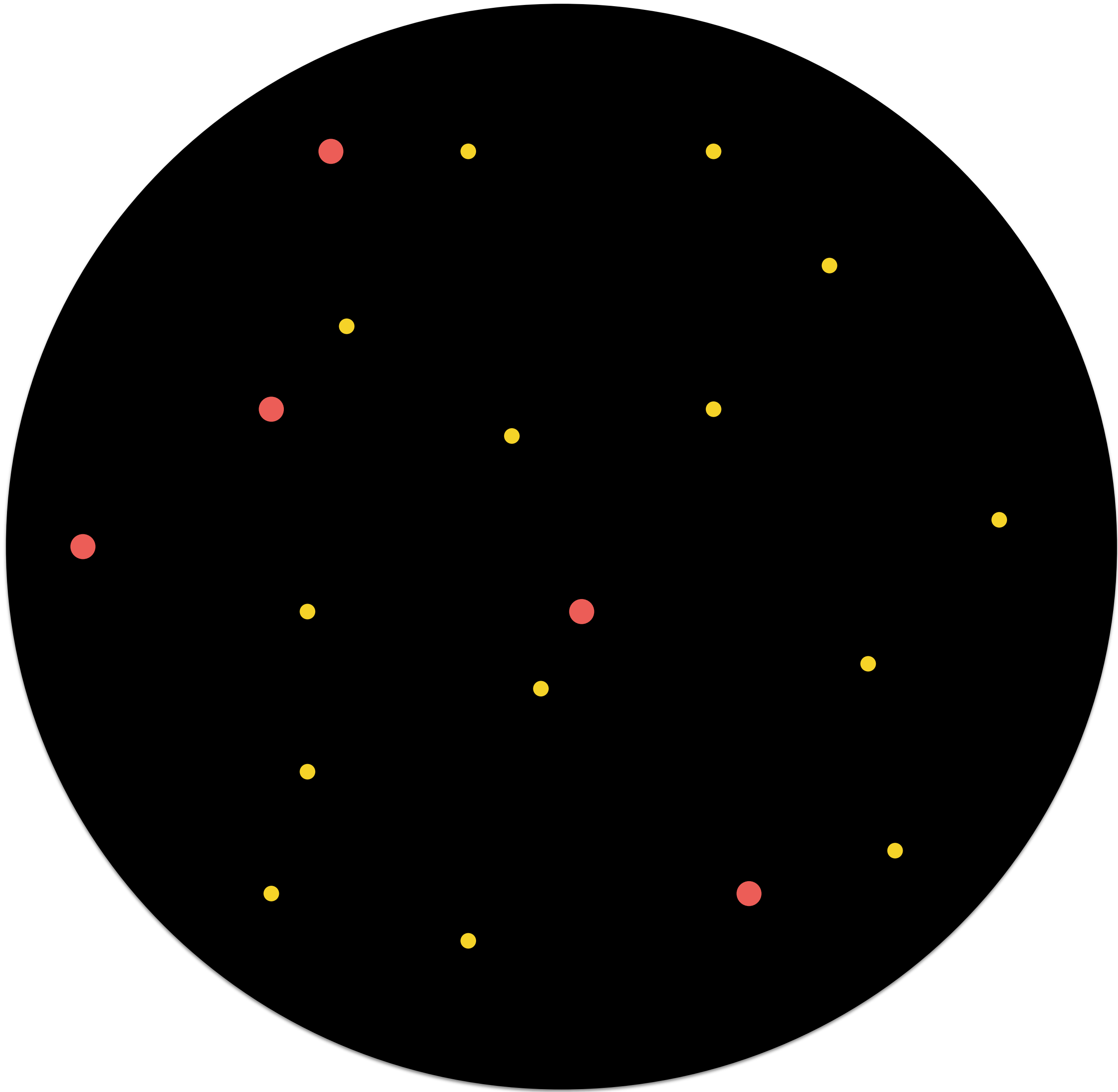
500 kpc

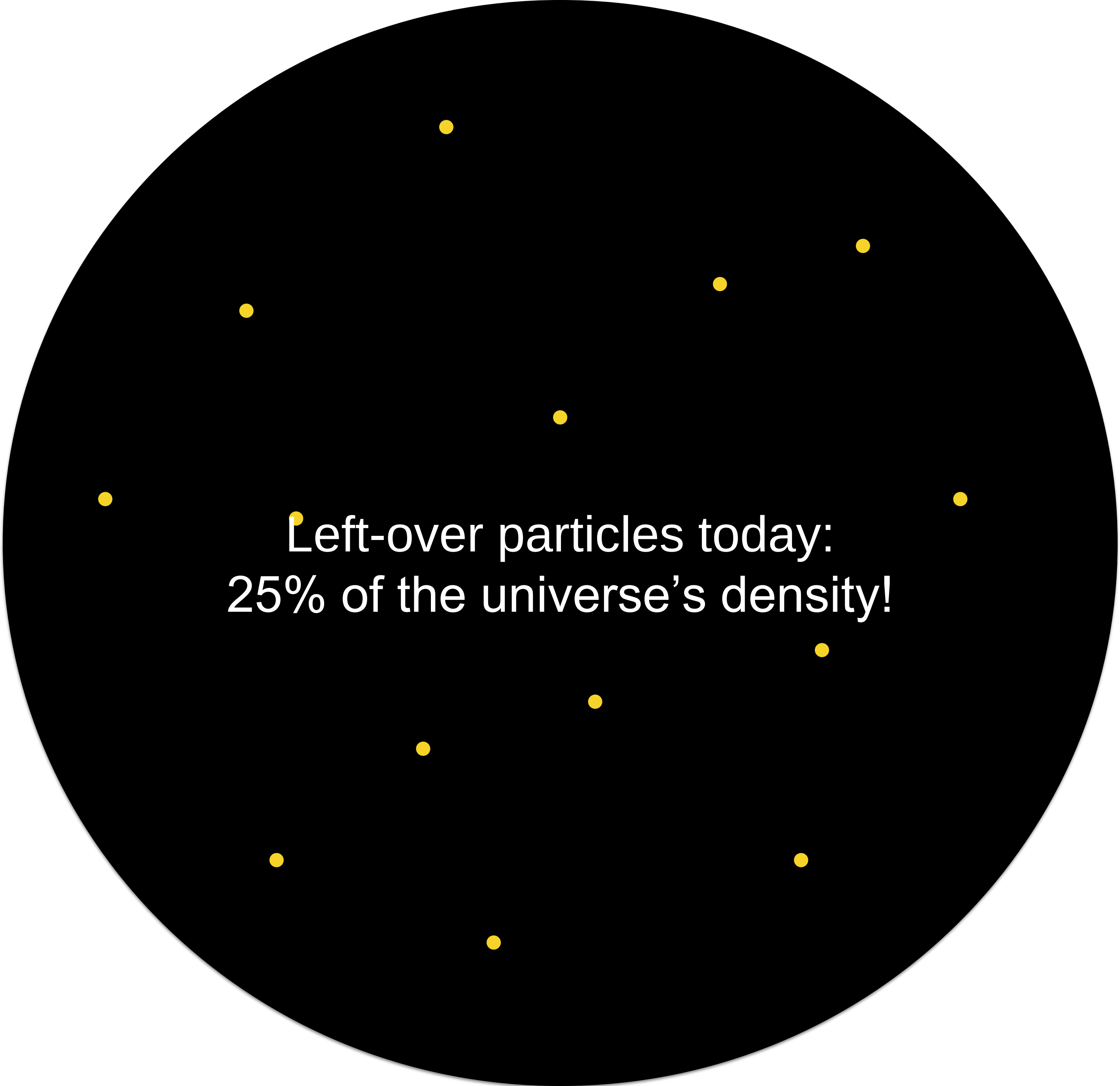
A visualization of a galaxy cluster at redshift $z = 0.5$, showing a dense field of galaxies and a bright central region. The galaxies are color-coded, with many appearing in shades of purple and blue, and some in yellow and green. The central region is particularly bright and dense. A scale bar at the bottom indicates a distance of 500 kpc.

Credit: Millenium
Simulation



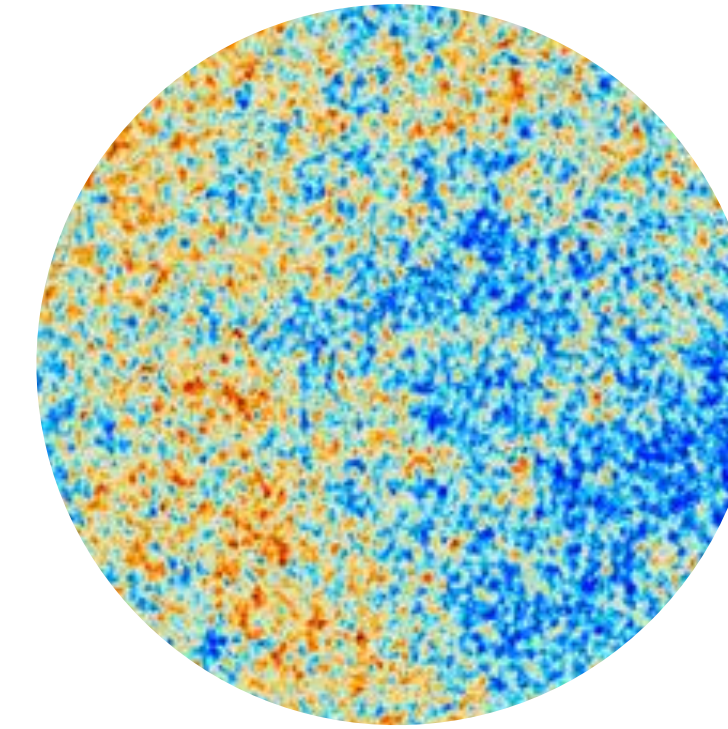
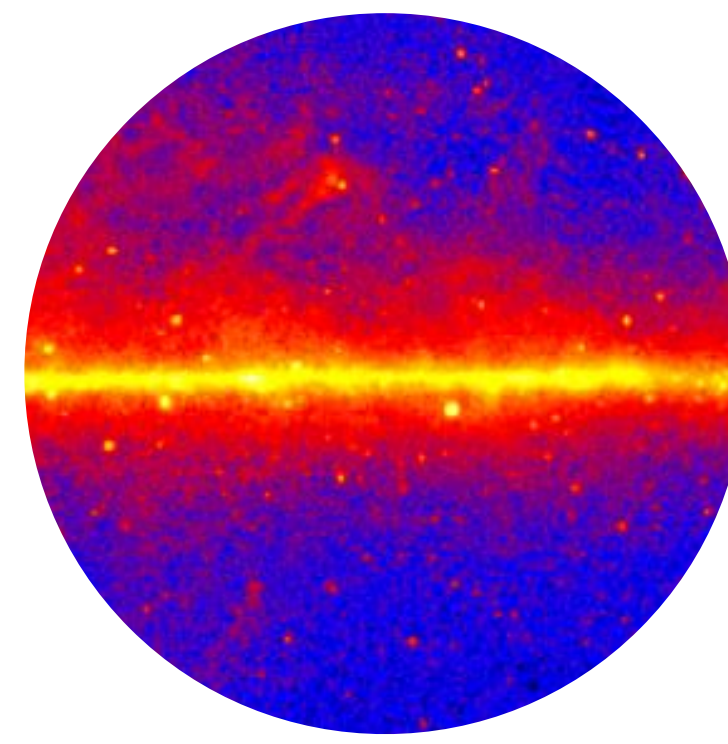
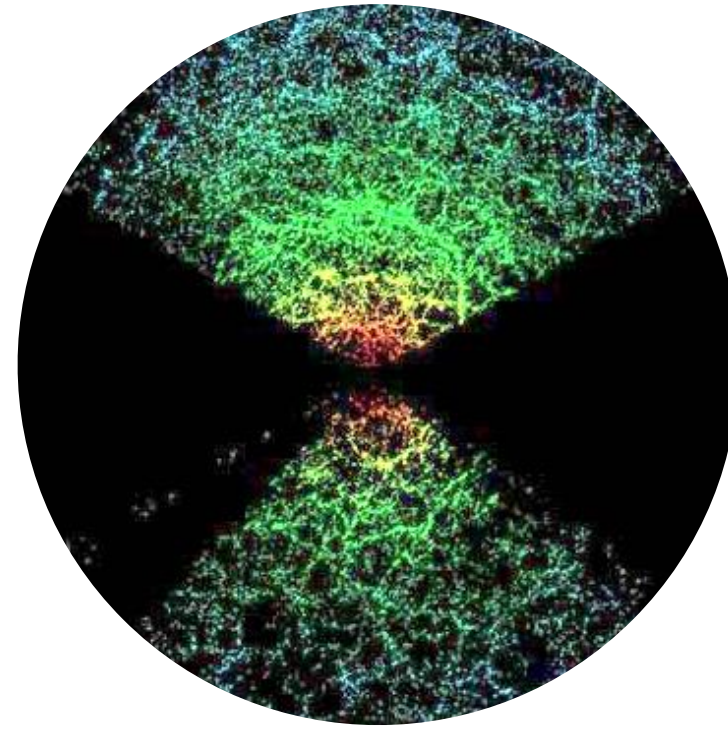






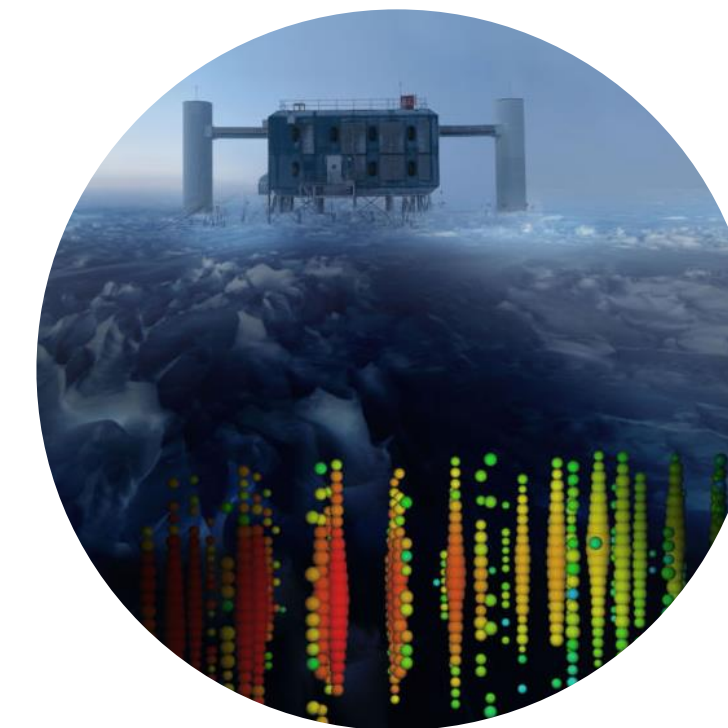
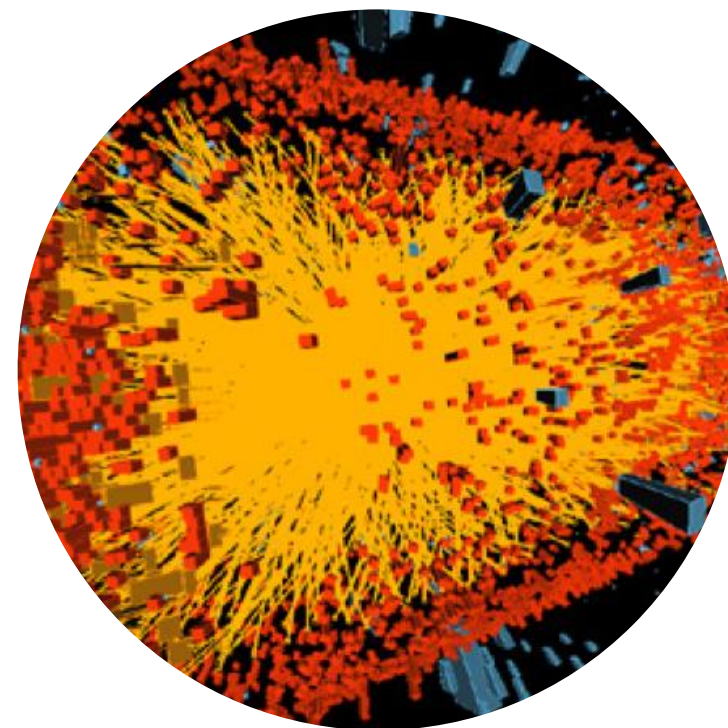
Left-over particles today:
25% of the universe's density!

Sky

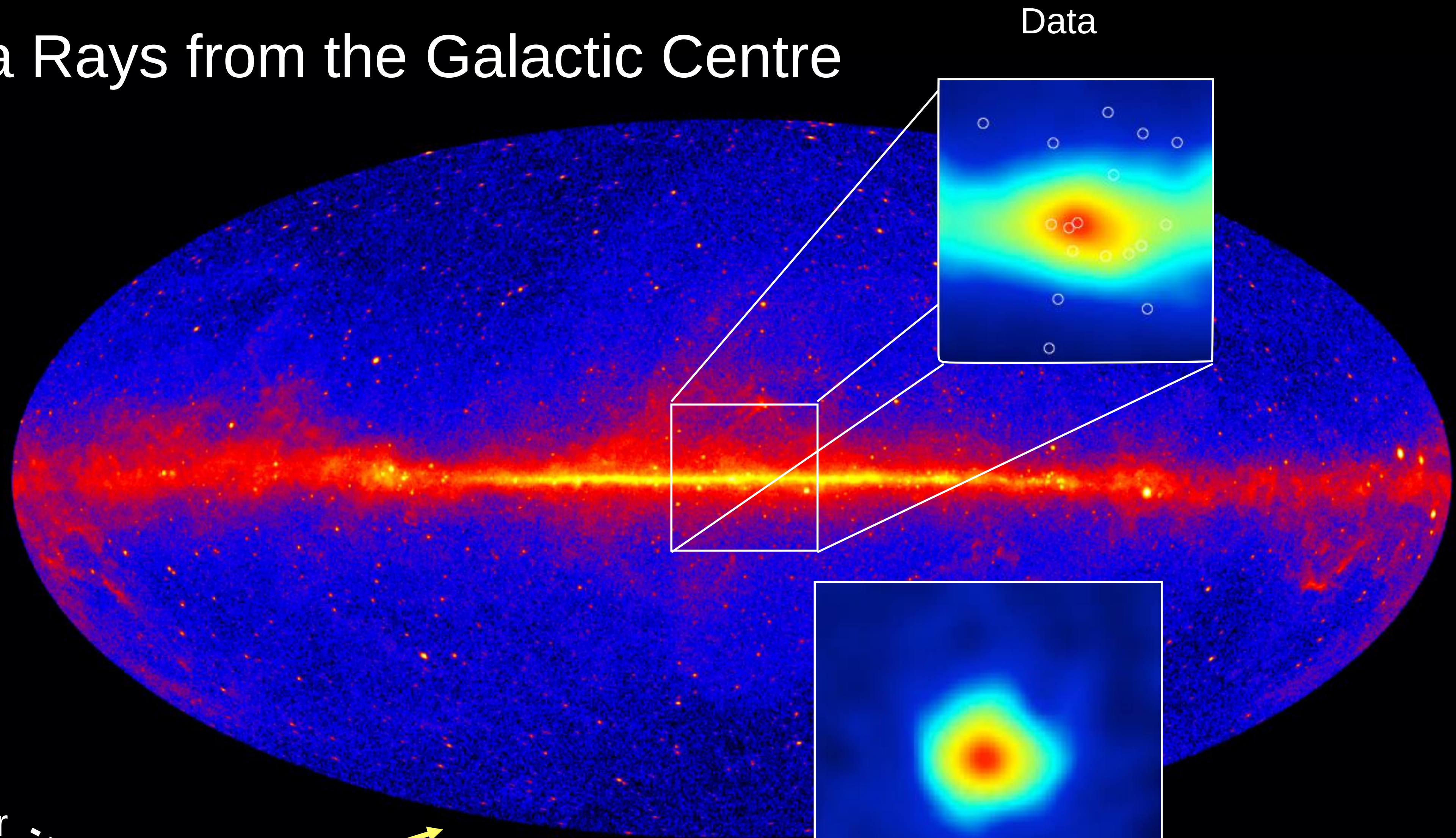


Dark
Matter

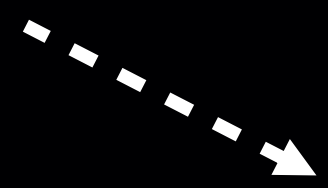
Earth



Gamma Rays from the Galactic Centre



Dark matter

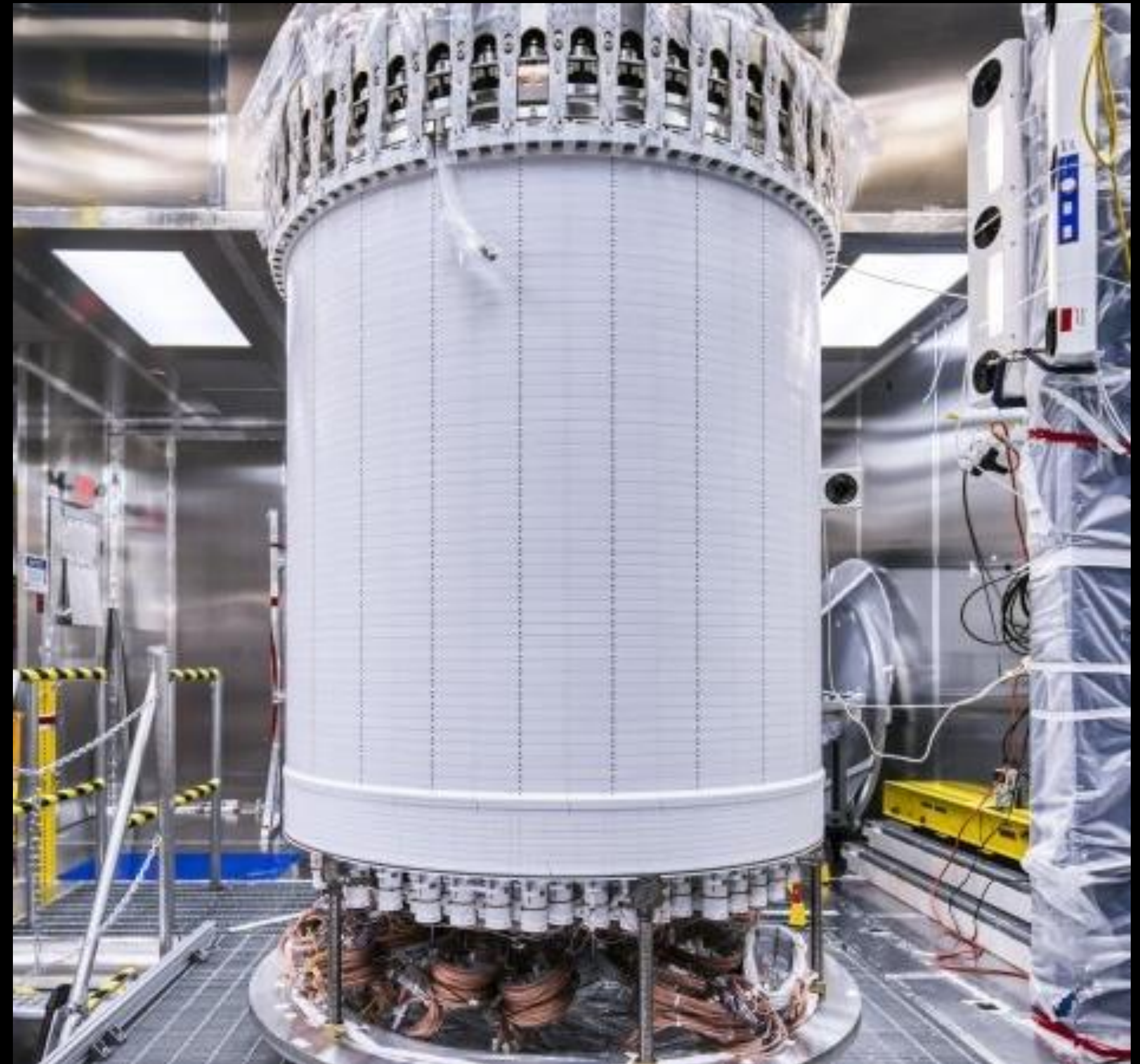
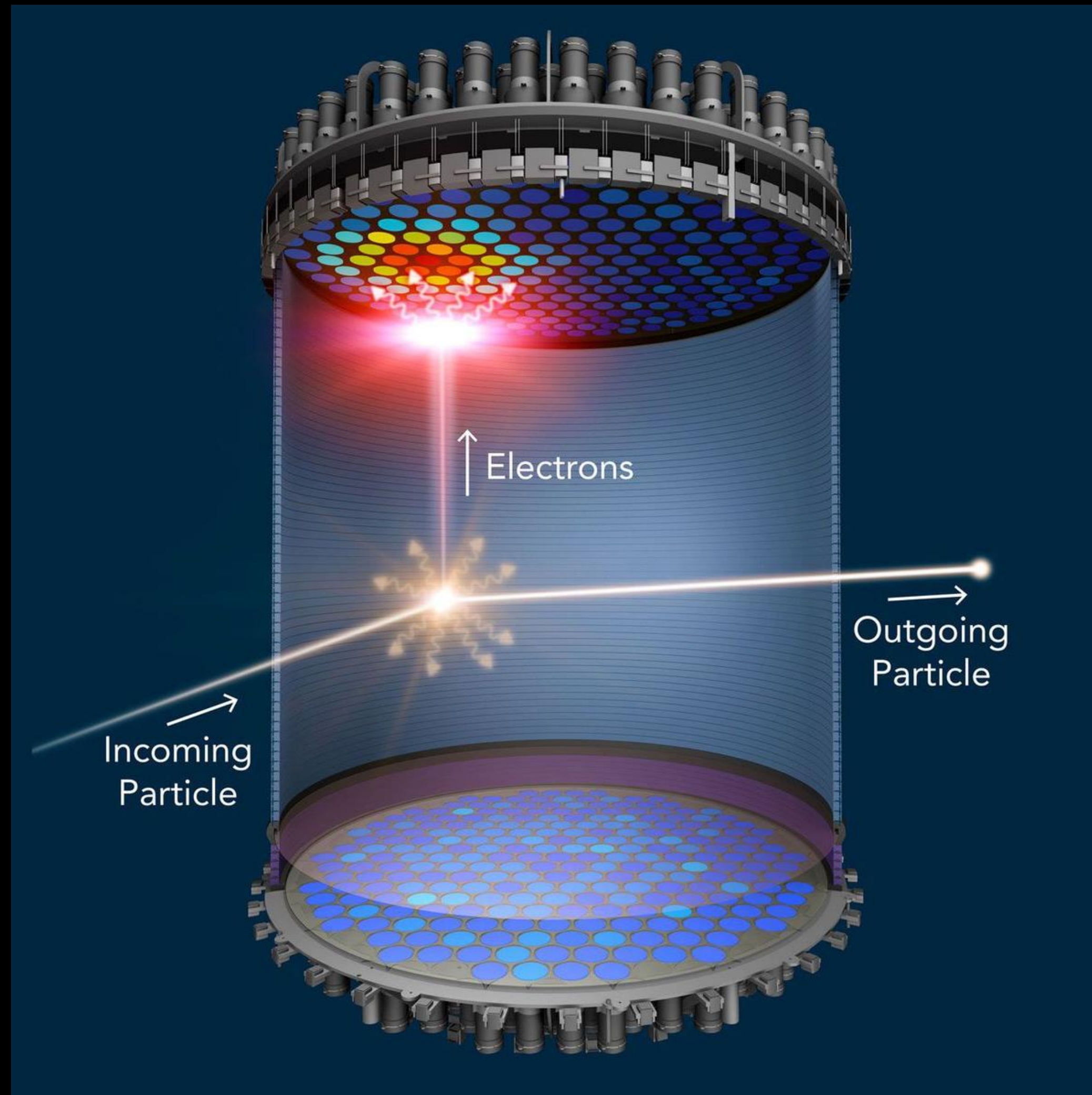


Dark matter

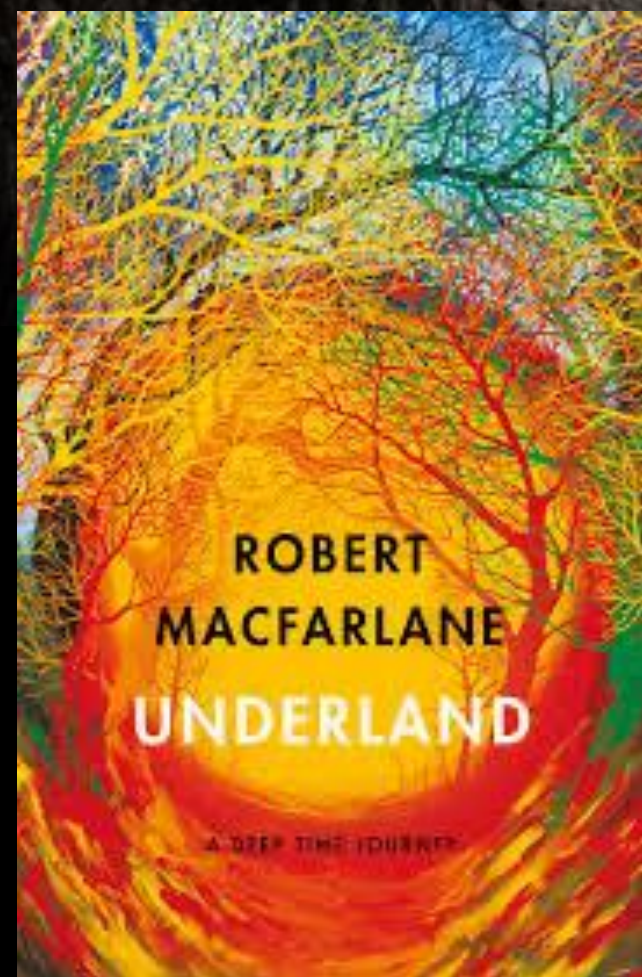
High-energy light
(gamma rays)

Dark matter
prediction

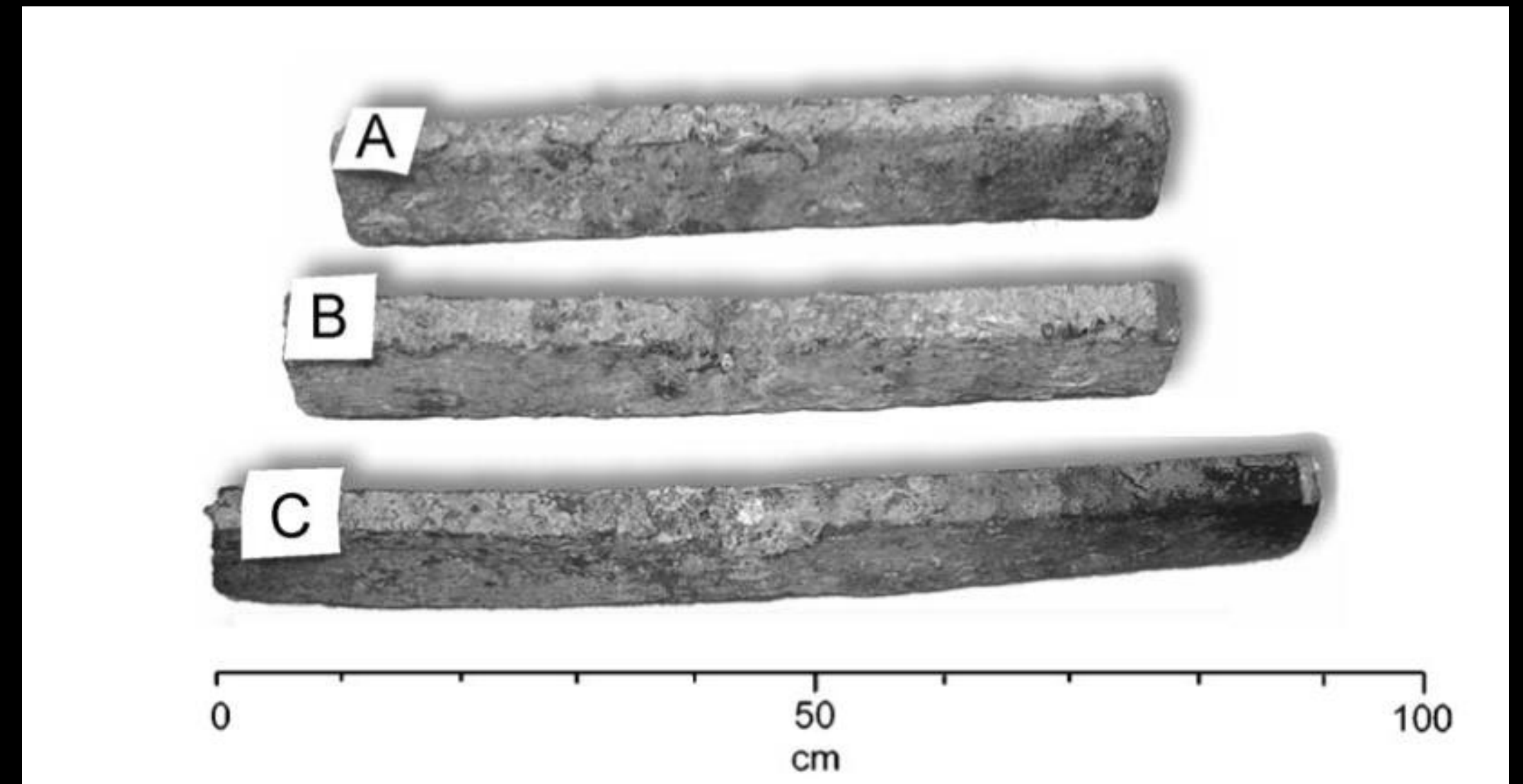
The LZ Dark Matter Detector



Looking for Dark Matter



Modern Tech, Ancient Lead

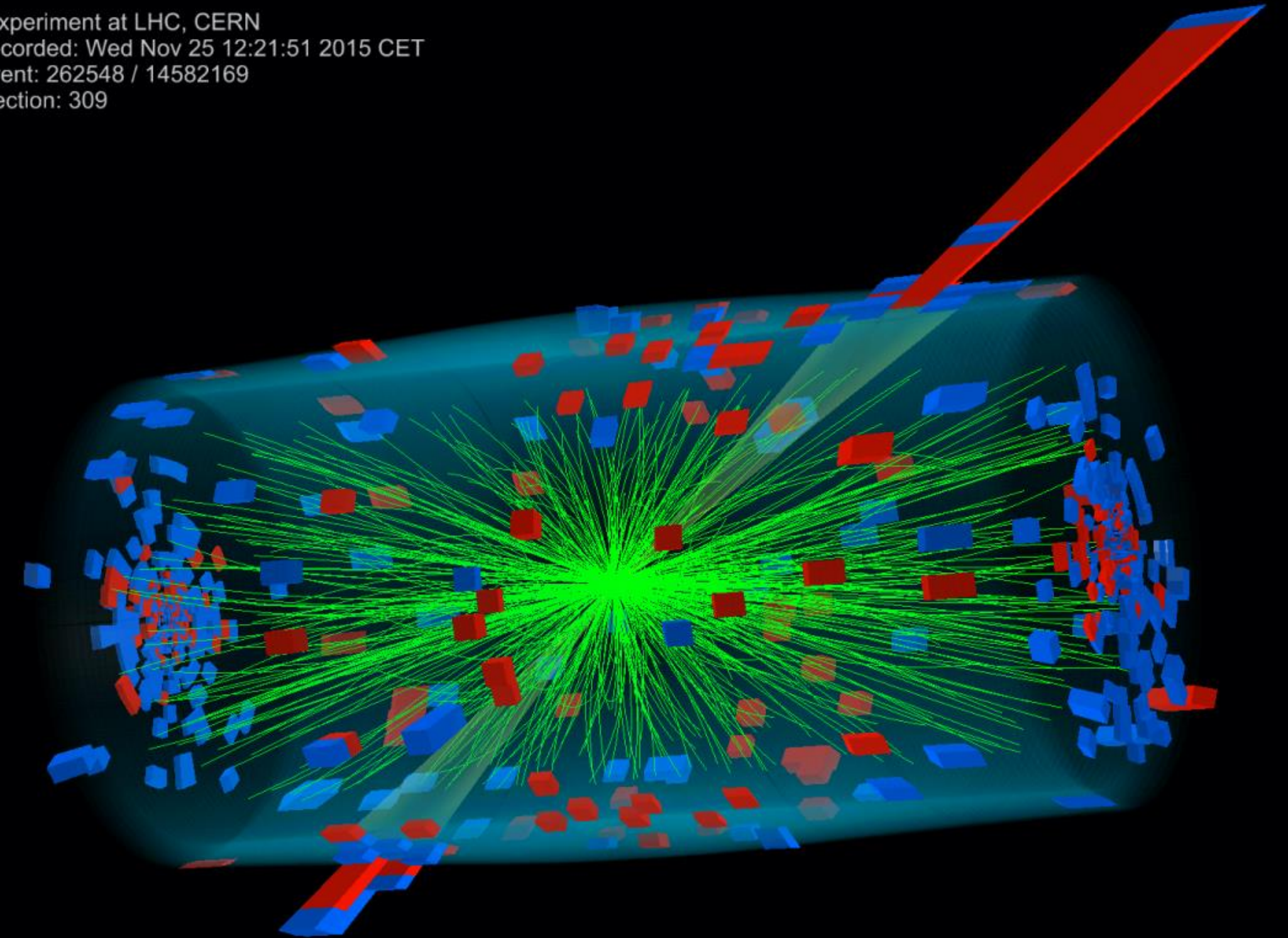
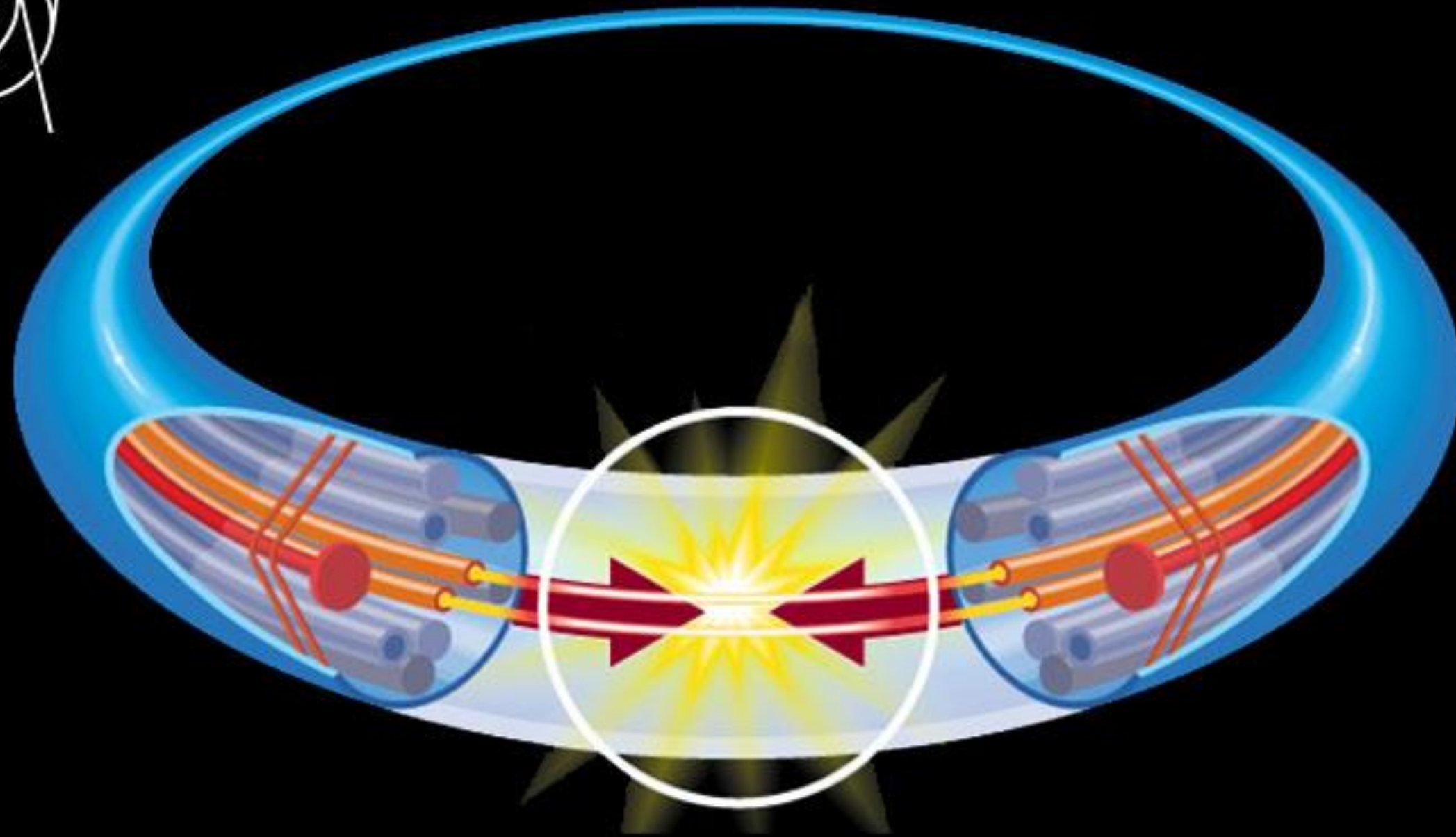


Danevich et al (2009)

The Large Hadron Collider



CMS Experiment at LHC, CERN
Data recorded: Wed Nov 25 12:21:51 2015 CET
Run/Event: 262548 / 14582169
Lumi section: 309



The Vera Rubin Observatory

Science first light: 2021

Mirror: 8.4m

Camera: 3,000 MPixels

Data flow: 30 TB/night

Yearly data: 200,000 images, 1.3 PB

Computing: 100 teraflops

