



HURTIGRUTEN

Astronomy Voyage



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LECTURE PROGRAMME

- Tonight's Night Sky
- Astrophotography
- The Aurora
- Our Solar System
- Our Galaxy
- **Our Universe**
- **Modern Astronomy: Life as a
Astronomer & Tools of the Trade**
- **Why We Are Here: A 13.8-billion
year-old story**



A wide-field photograph of the night sky, showing the Milky Way galaxy as a dense band of stars and dust stretching across the frame. The Andromeda Galaxy is visible as a distinct, bright, elliptical object on the left side. The sky is dark blue/black, and the foreground shows dark, silhouetted trees and structures.

Milky way

< Andromeda
nebula

Large Magellanic Cloud



Are they small & nearby,
or large & far away?

Spiral Nebulae



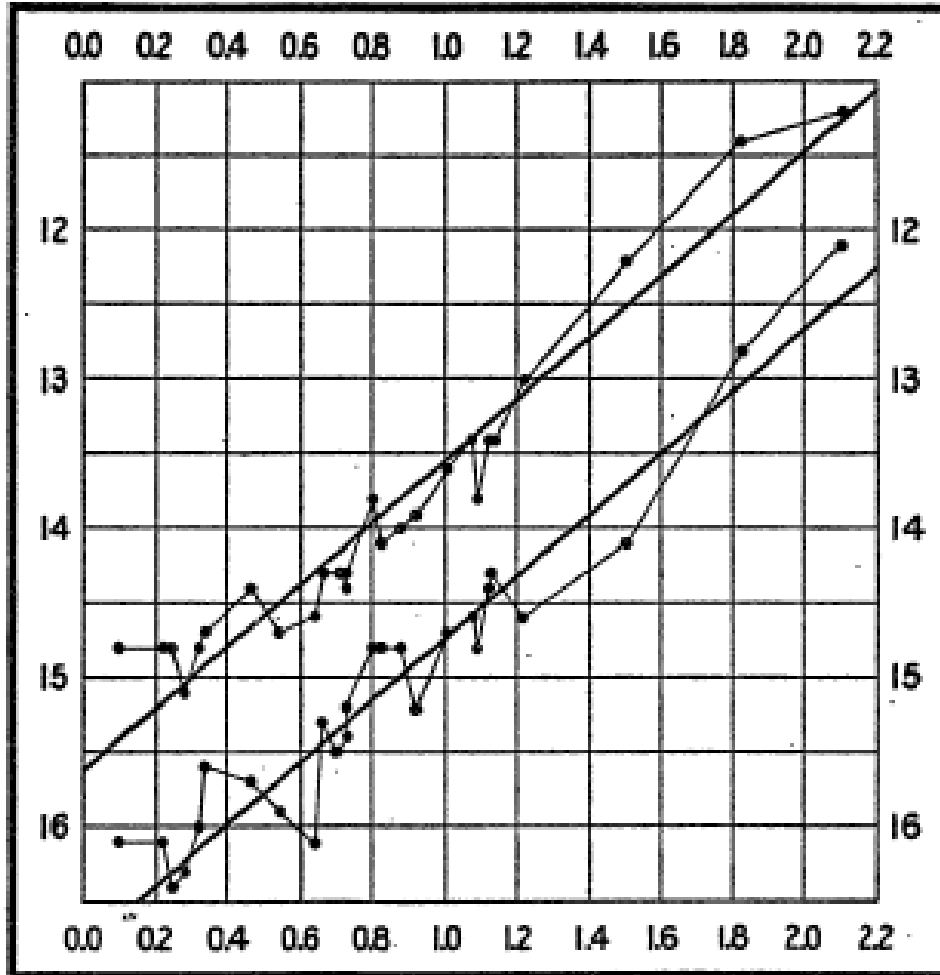
Galaxy M51

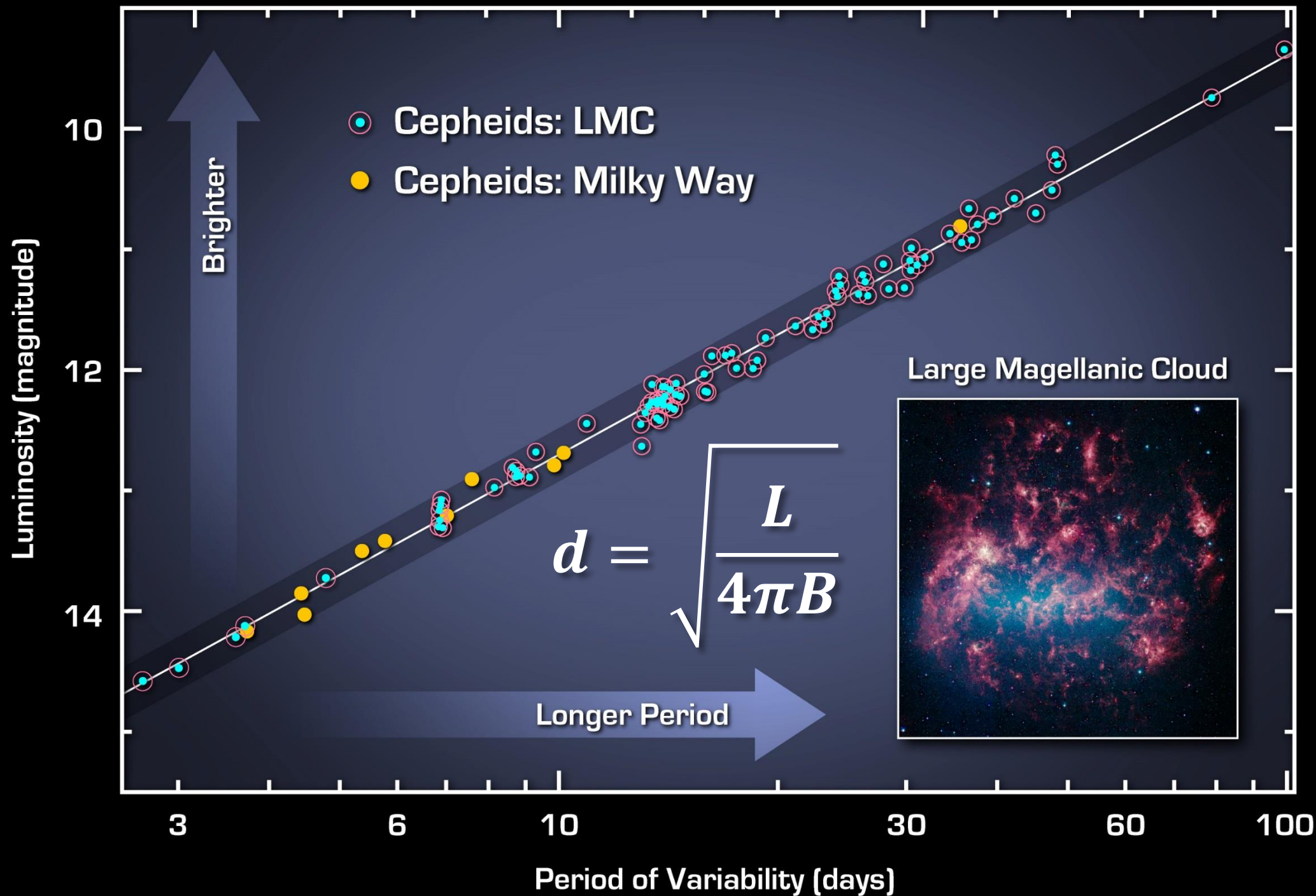


Young star & disk MWC 758

MWC 758
ESO/VLT

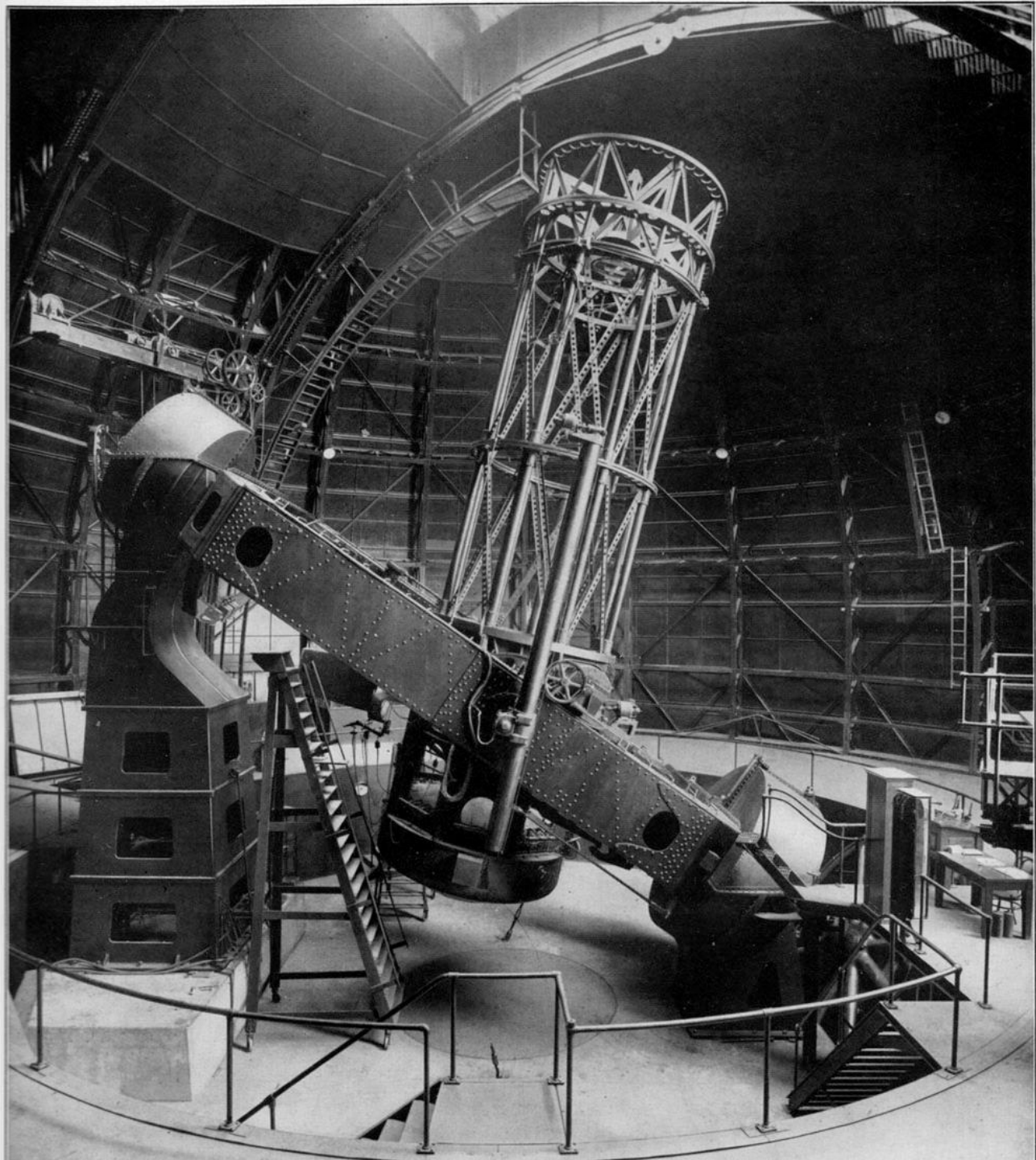
Henrietta Swan Leavitt & Cepheid Variable pulsating stars







Hubble



Orion Nebula, M42

25,000x bigger than our solar system



Andromeda Galaxy, M31

250 million x bigger than our solar system



Our Solar System
 $50\text{AU} = 7 \text{ light hrs}$

Our Galaxy
 $\sim 100,000\text{ly}$



The Andromeda Galaxy

2.5 million light years away



Hubble Space Telescope Ultra-Deep Field

FOV:
0.2% Moon

1 Ms
(12 day)
exposure

10,000 galaxies



The image is a deep field photograph from the James Webb Space Telescope, showing a vast number of galaxies in various shapes and sizes, including spirals, ellipticals, and irregulars, against a black background. The galaxies are primarily orange and red, with some blue and white stars interspersed. A bright star in the upper center has prominent blue diffraction spikes. A faint blue grid is overlaid on the image.

James Webb Space Telescope Deep Field

FOV: 10% Moon

12.5 hour
(45ks) exposure

45,000 galaxies



Most distant object ever imaged
13.4 G ly distant



500 years out of a star's ~10bn year life

≡

2 minutes out of our lifetime



Galaxy types

Elliptical Galaxies

M87



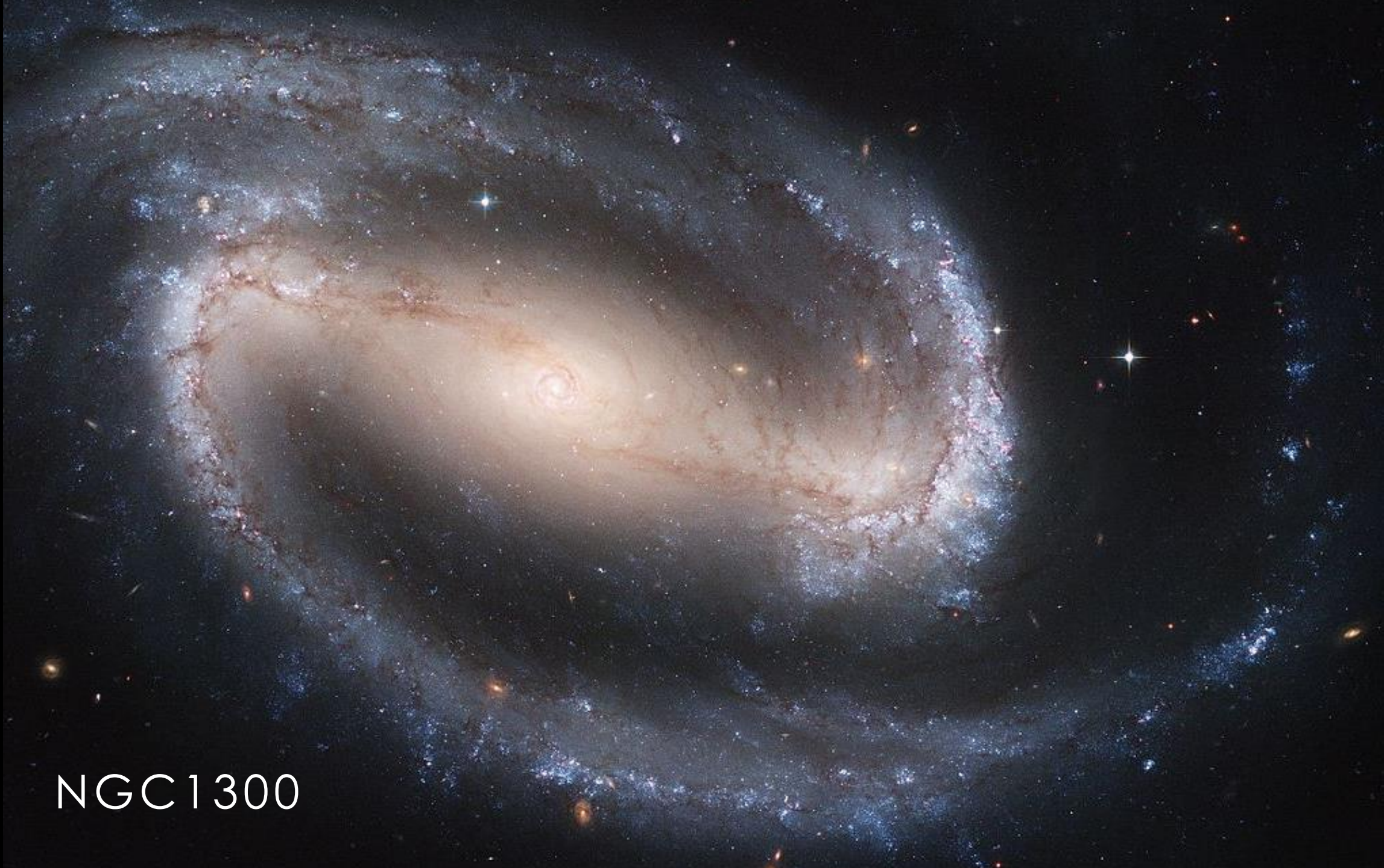
Spiral Galaxies

Pinwheel Galaxy, M101



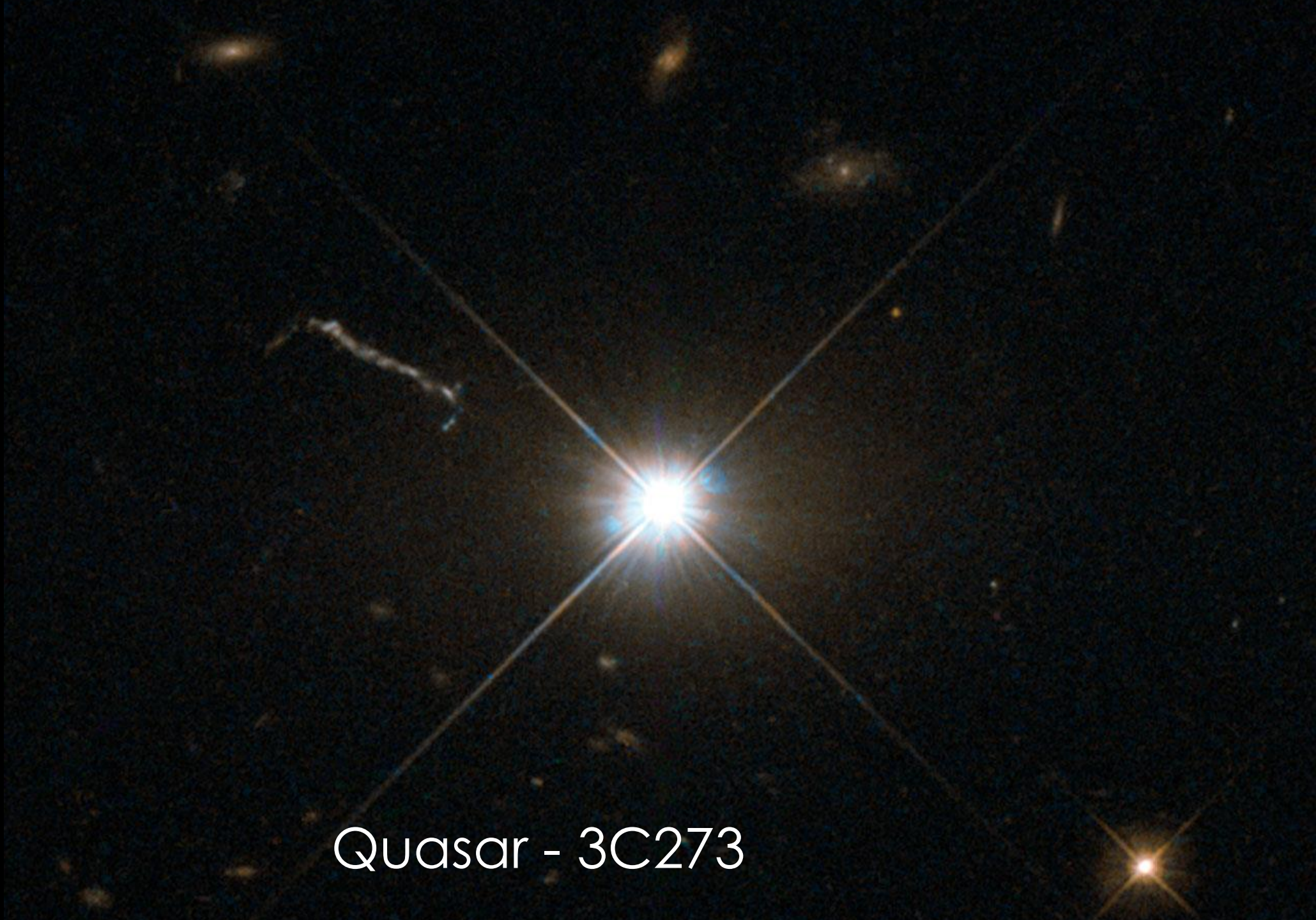
Barred Spiral Galaxies

NGC 1300



Quasars

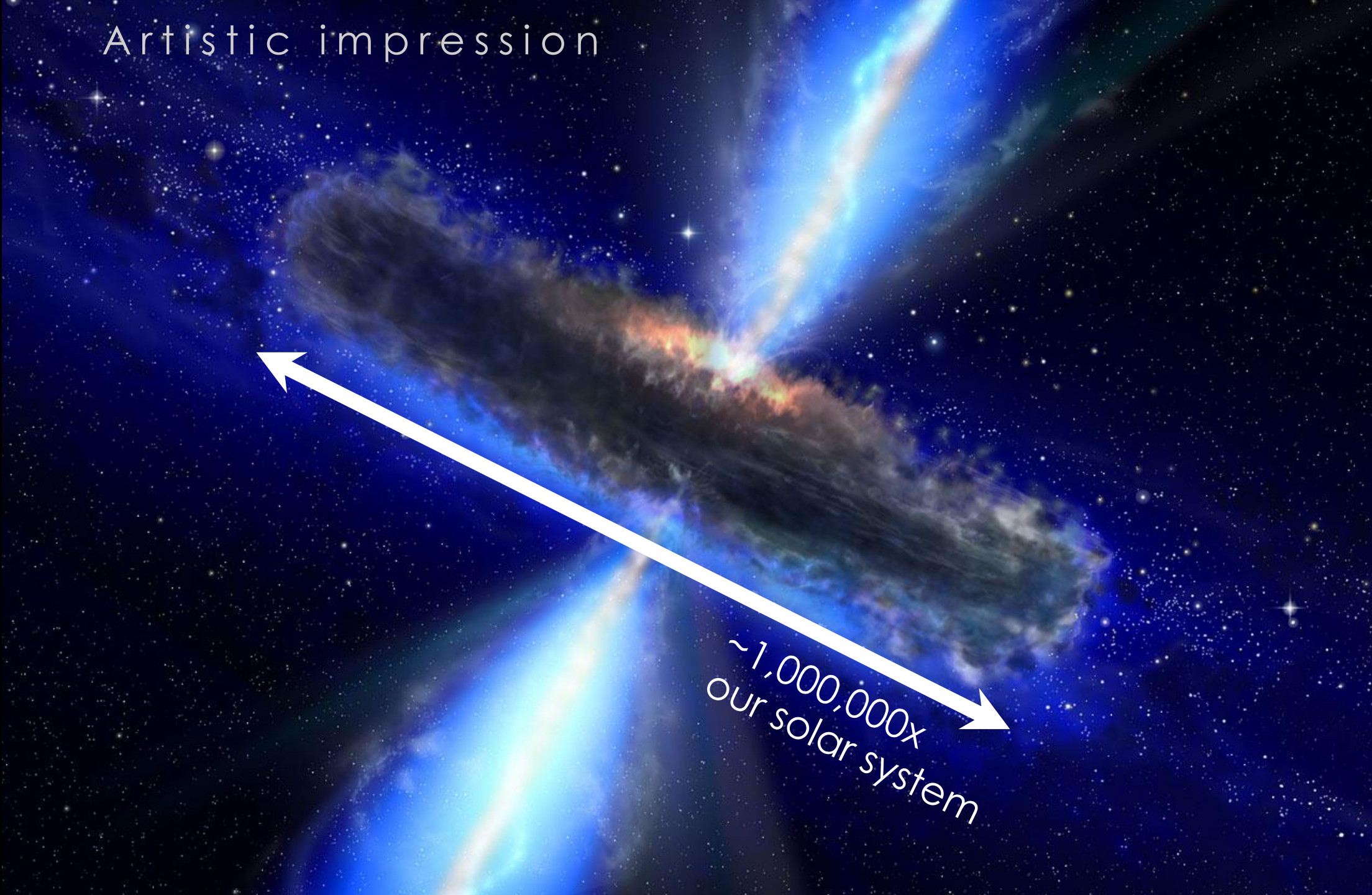
Quasar - 3C273

This is a deep-field astronomical photograph of the quasar 3C273. The central feature is a brilliant, multi-colored point source (white, blue, and orange) with prominent diffraction spikes. Two long, thin, and slightly curved jets of light extend diagonally from the central source across the dark, grainy background of the sky. Several other celestial objects are visible, including a faint, elongated galaxy-like structure to the upper left and a smaller, bright star-like object in the lower right corner.

Quasars

Artistic impression

~1,000,000x
our solar system

An artistic rendering of a quasar, showing a bright, glowing blue and white central region with two powerful jets of light extending outwards. The central region is surrounded by a dark, dusty disk. A large white arrow points from the bottom right towards the center, indicating the scale of the object.

Interacting / Irregular

Galaxies



The Antennae
Galaxies

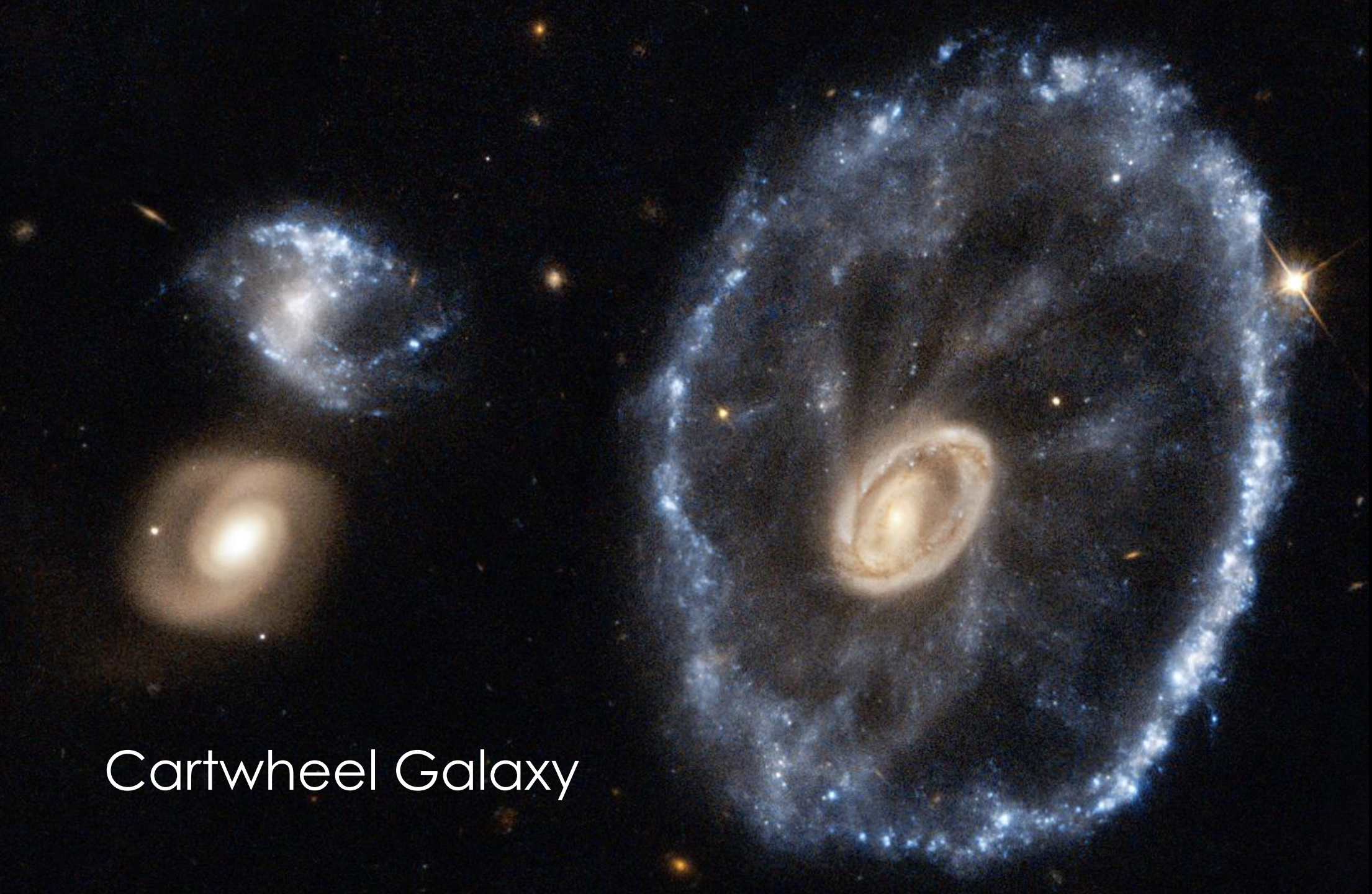


0.000 billion years

Interacting / Irregular

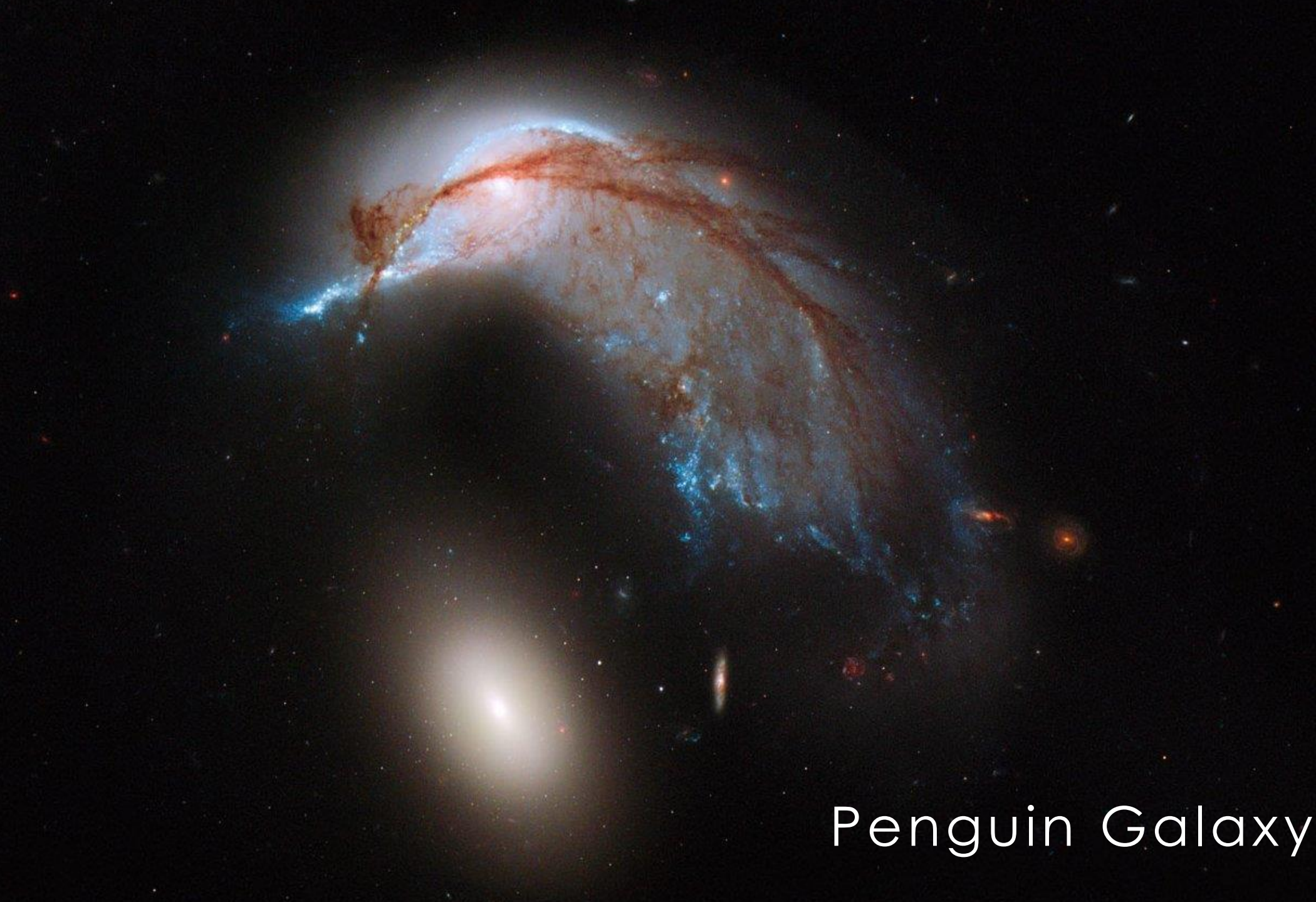
Galaxies

Cartwheel Galaxy



Interacting / Irregular

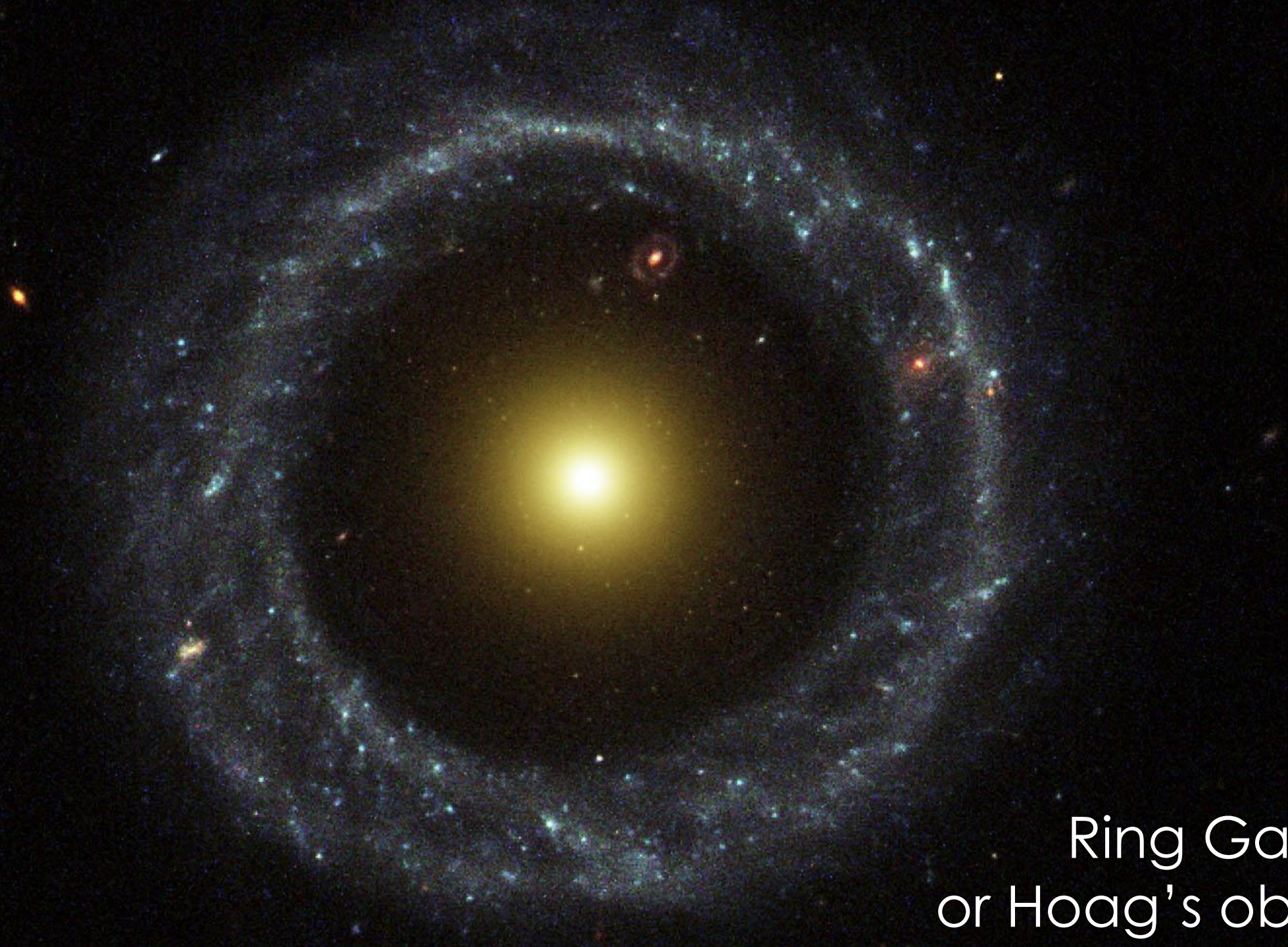
Galaxies



Penguin Galaxy

Interacting / Irregular

Galaxies



Ring Galaxy
or Hoag's object

Galaxy Clusters

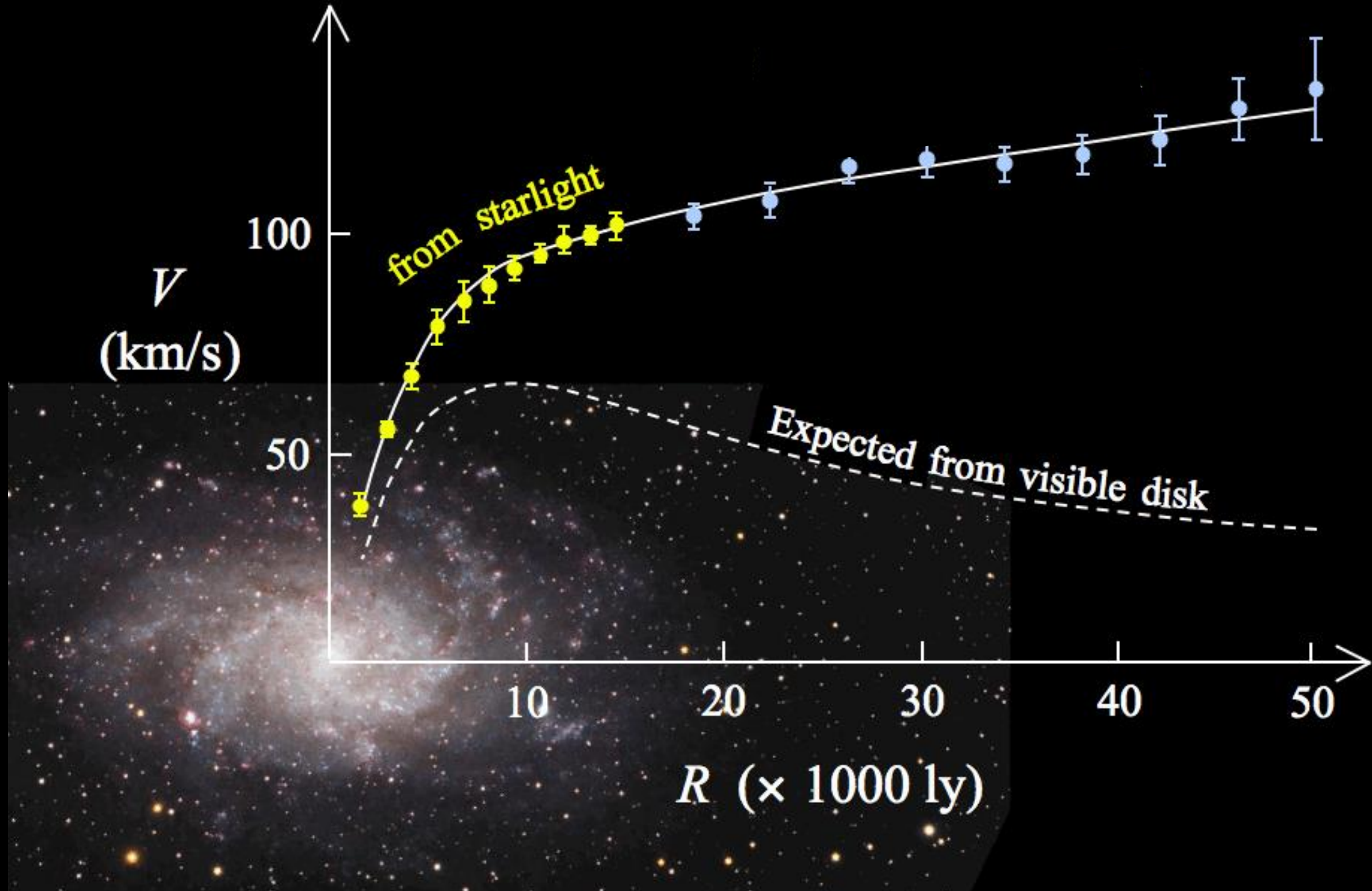
Virgo cluster of ~1500 galaxies



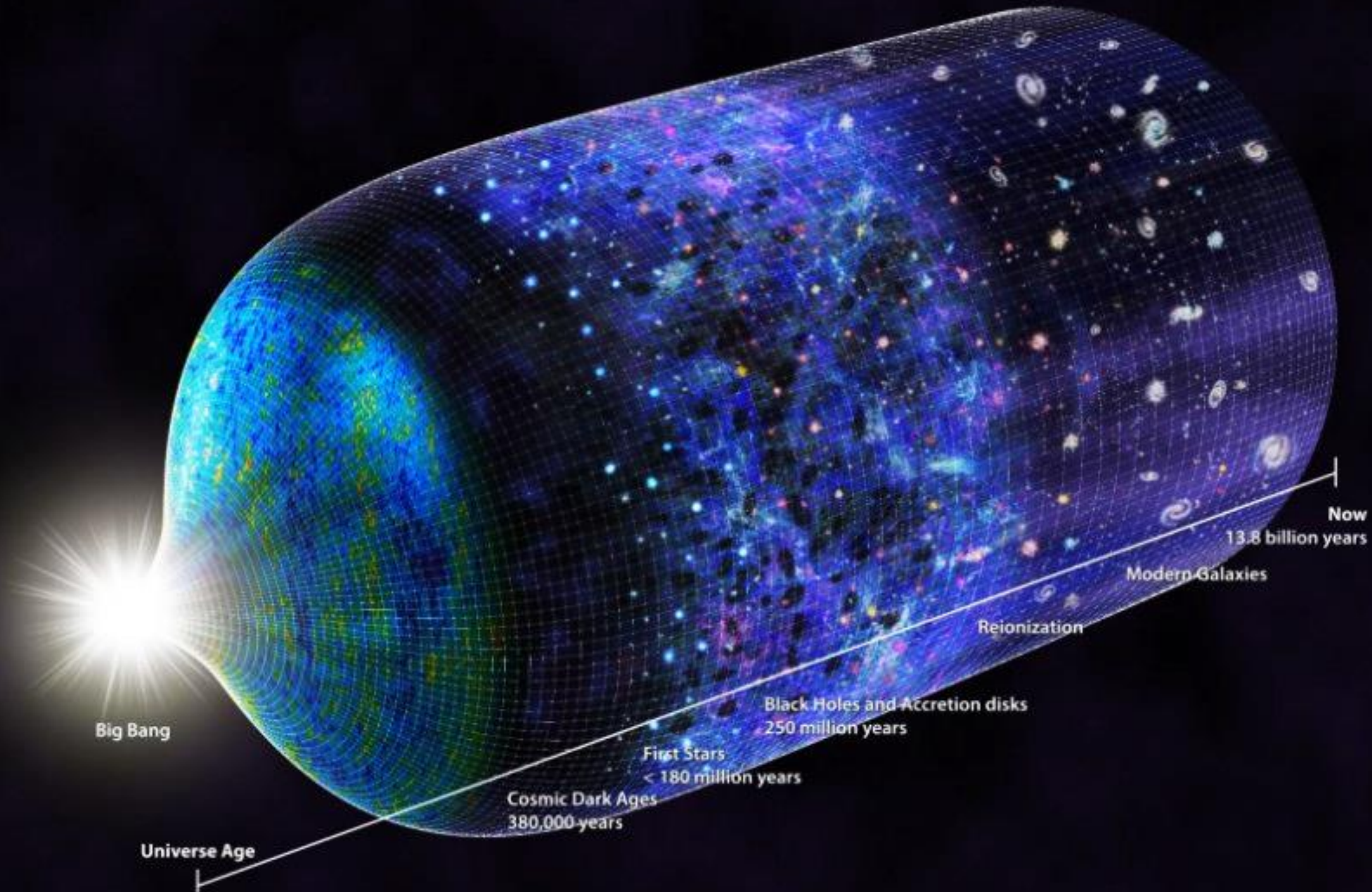
Dark Matter



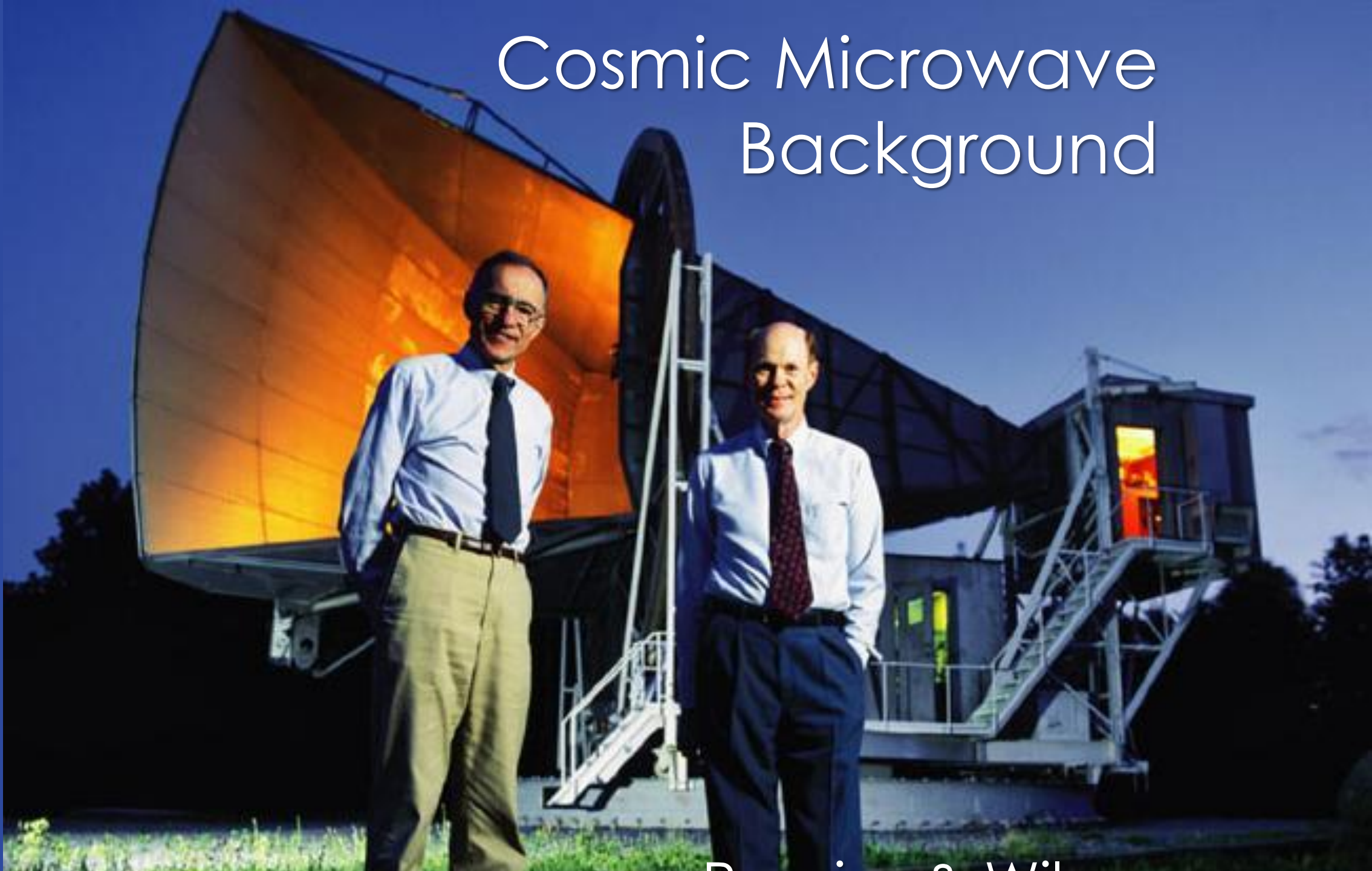
Vera Rubin

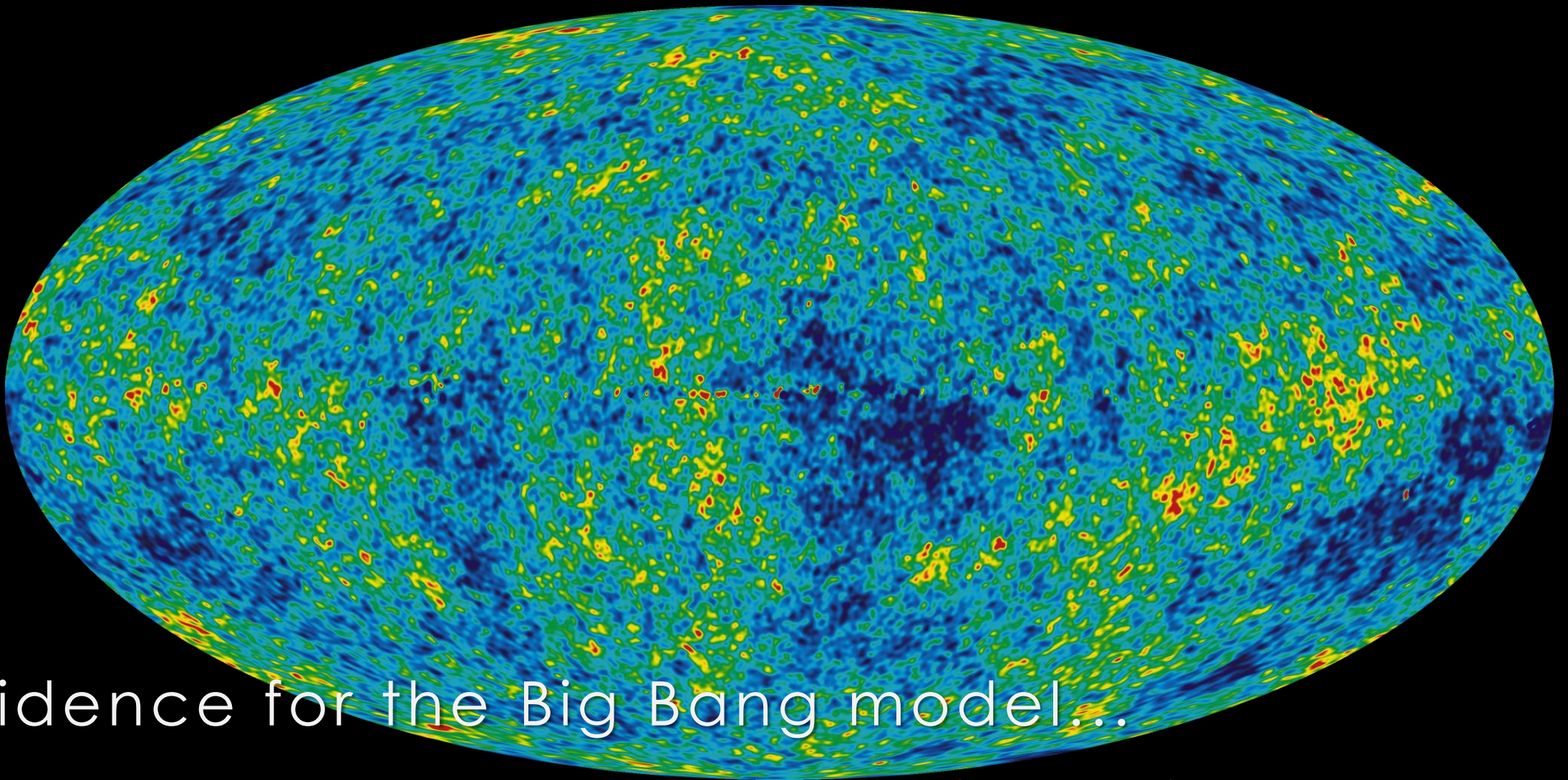


The Big Bang



Cosmic Microwave Background





Evidence for the Big Bang model...

The observed expansion of the Universe

The wavelength of the CBR

The observed abundances of the light elements

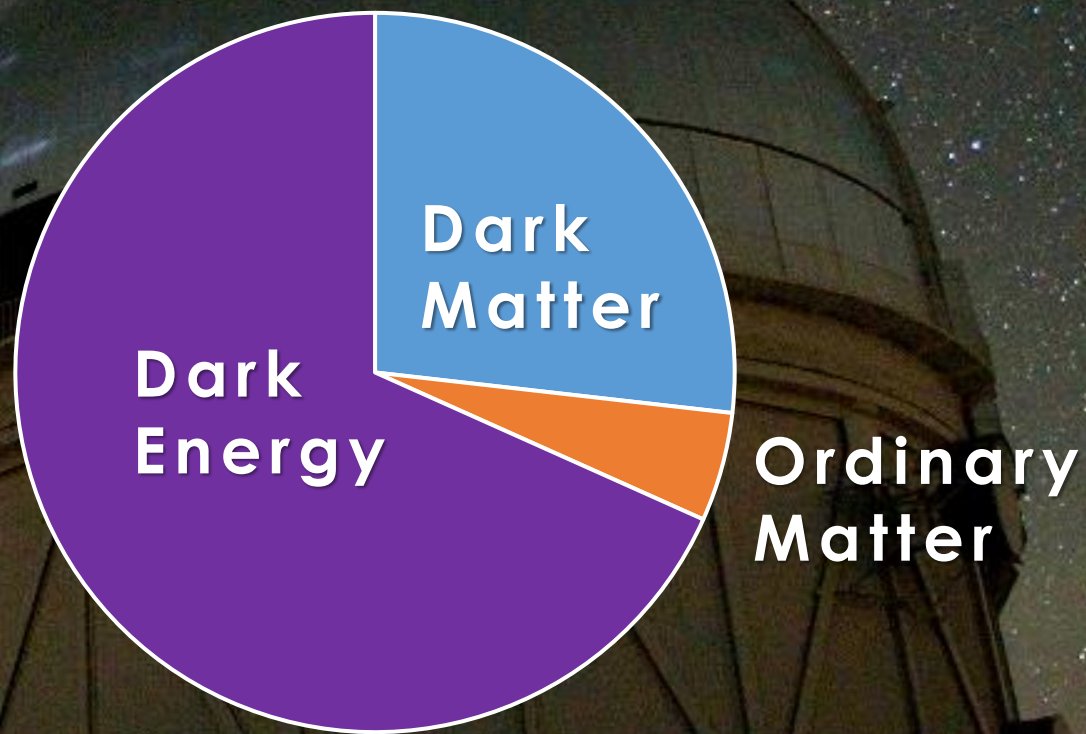
Artistic Impression of a type 1a Supernova



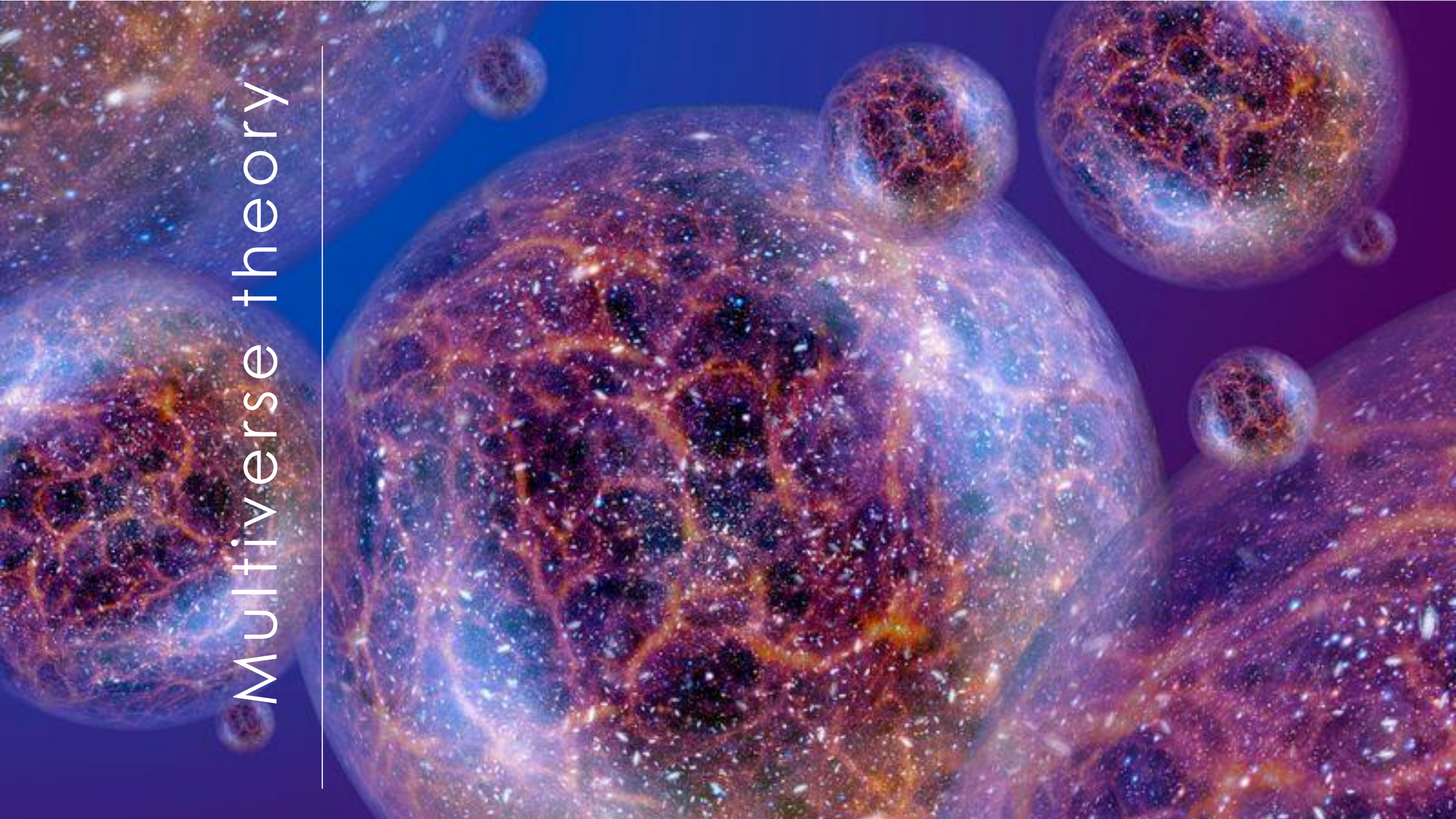
An Accelerating Universe

Dark Energy

An Accelerating Universe



Multiverse theory





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