
The Hubble Space Telescope

Edwin Hubble 1889-1953:

Edwin Hubble's main achievments

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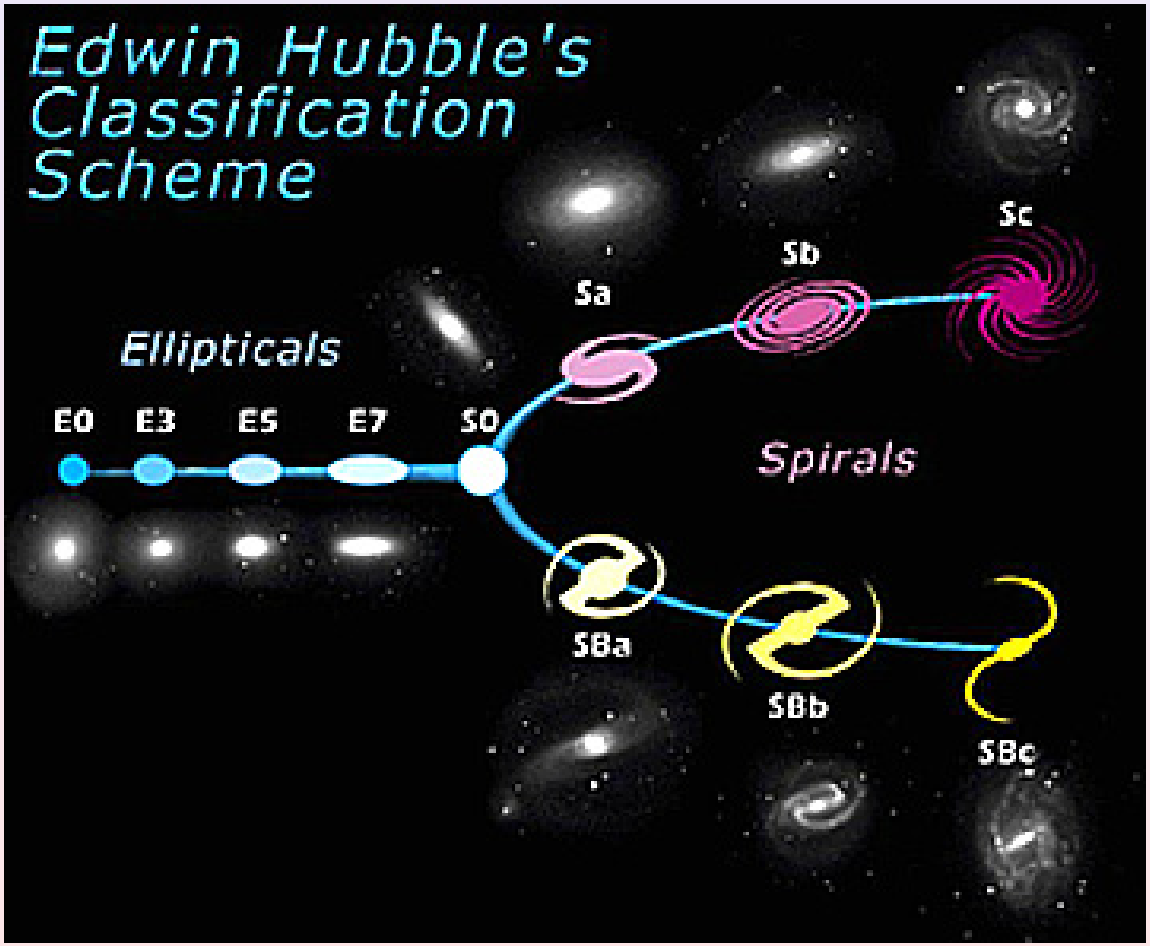

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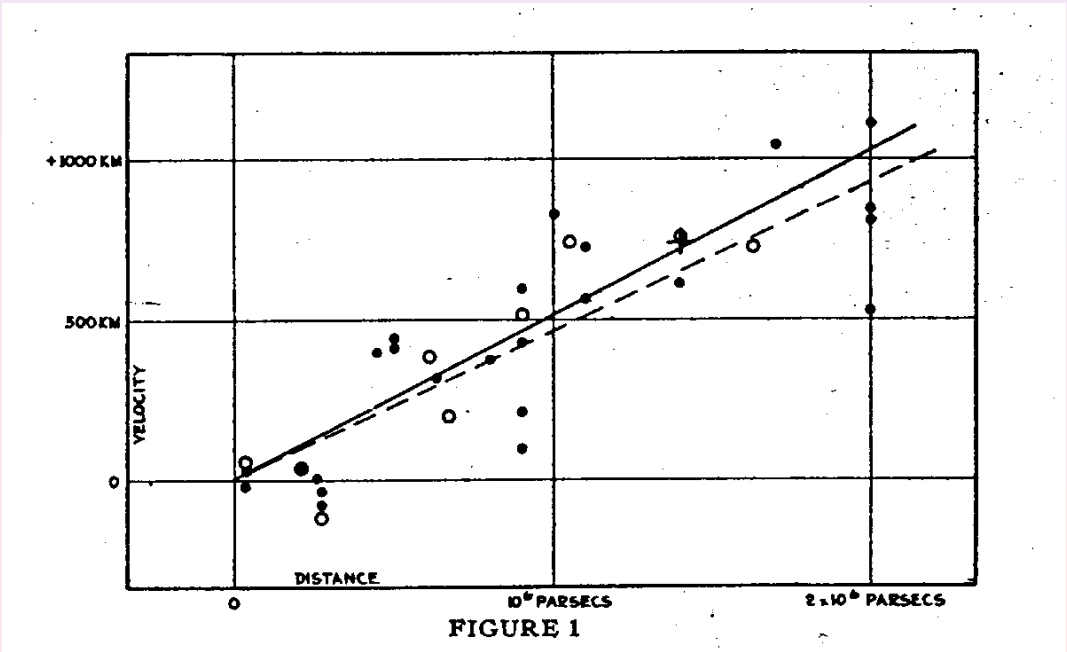

FIGURE 1

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- Hubble's law: $v(r) = Hr \Rightarrow$ expanding Universe
- evidence for homogenity of the Universe:
  cosmological principle

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- mirror don't focus properly!
- repair mission December of 1993
- it works!

Advantages of telescopes in space:

- no seeing $\Rightarrow$ angular resolution only limited by diffraction
  - traditional ground-based telescopes: resolutions of 0.5-1.0″
  - diffraction-limited resolution: $\sim 0.1''$ for a 2.5 m mirror

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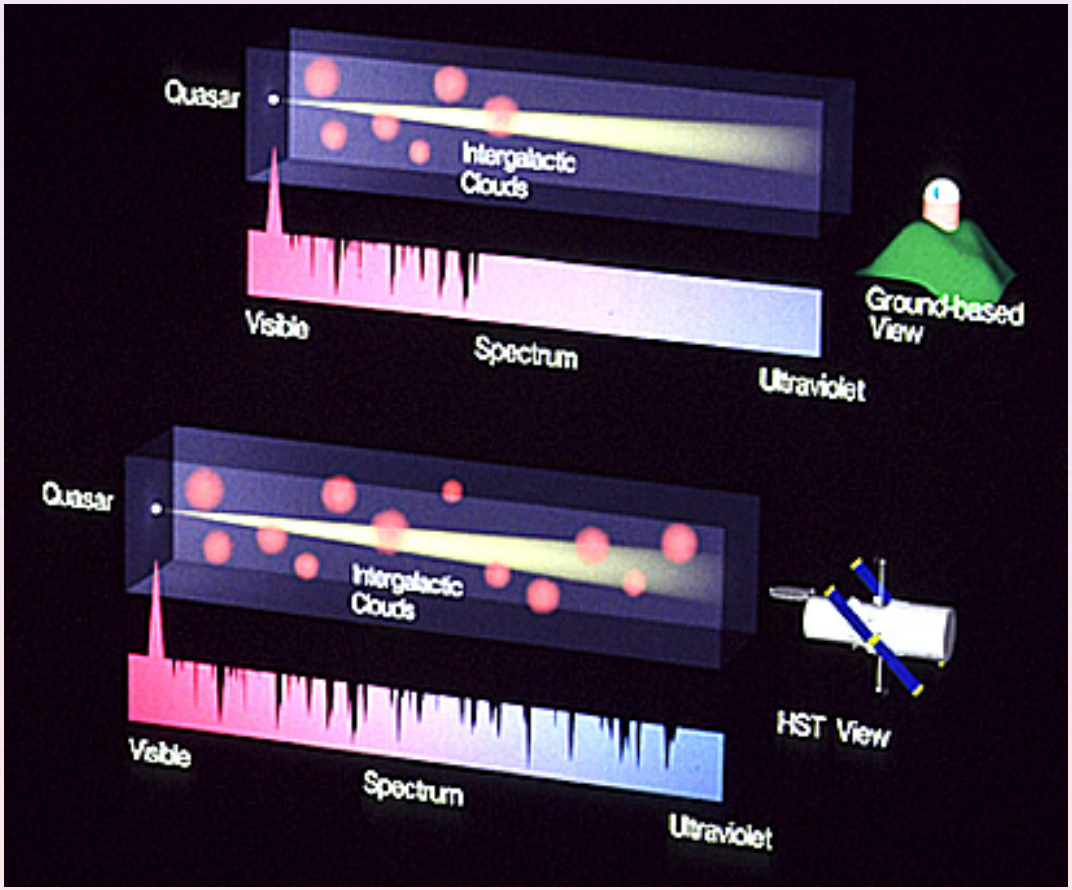

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- IR and UV performance:
- no light pollution, no clouds

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- maneuvering with electrically driven reaction wheels

Scientific Instruments:

changed heavily during more than 15 years!

- Wide Field Planetary Camera
- Faint Object Camera
- Near Infrared Camera and Multi-Object Spectrometer
- Imaging Spectrograph

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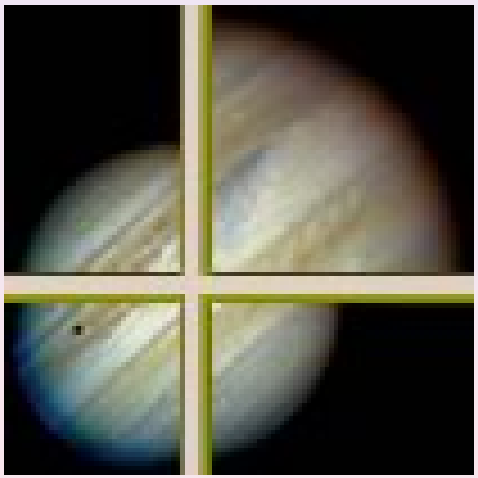

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  Hubble deep field view: high exposure pictures of two "typical" sky regions

Scientific Instruments:

Faint Object Camera:

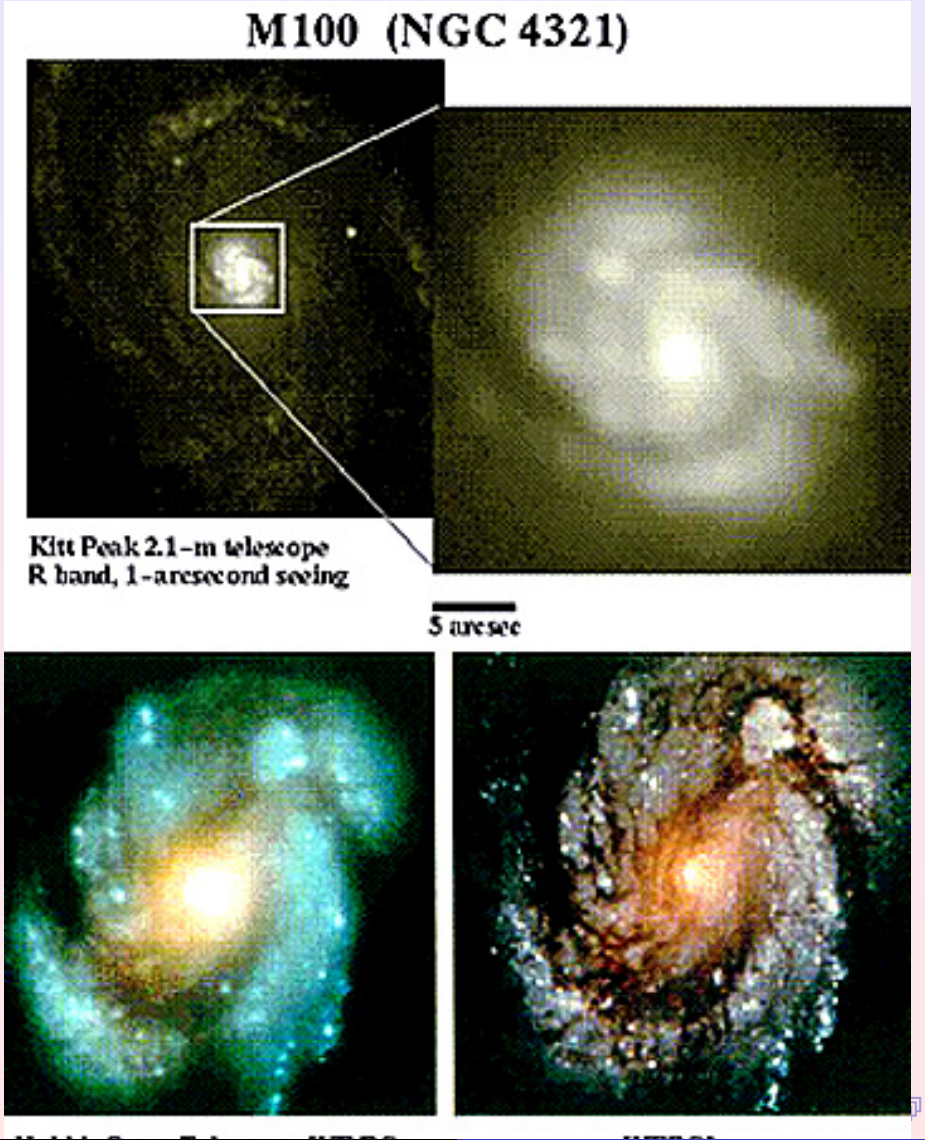
- provide high-resolution images of small fields
- filters, prisms (for slitless spectroscopy), and polarizers may be placed in the optical beam.
- FOV 14×14 arcsec

Near Infrared Camera and Multi-Object Spectrometer:

Space Telescope Imaging Spectrograph:

- ultraviolet to the near-infrared spectrograph

Comparison before/after COSTAR:



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- birth of stars, planetary systems
- death of stars, supernovae

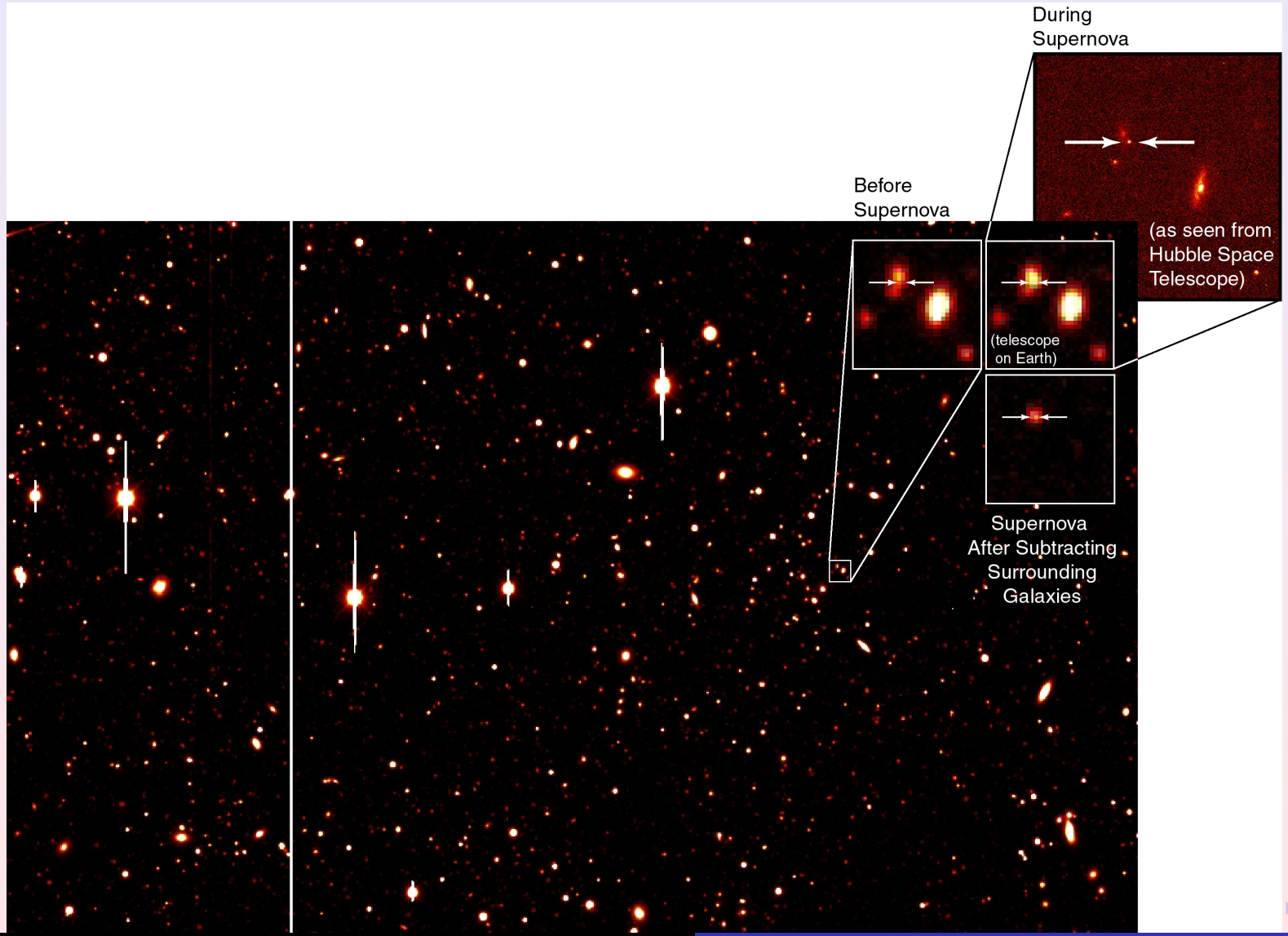
Hubble Space Telescope Key Project:

Cepheides as standard candels

- observed 19 galaxies out to 108 million light-years
- discovered almost 800 Cepheid variable stars
- recalibrated the “cosmic distance scale”
- reduction of error in H from 50% to 10%

Most distant galaxy with measured Cepheides, NGC 4603:

High z Supernovae Project:



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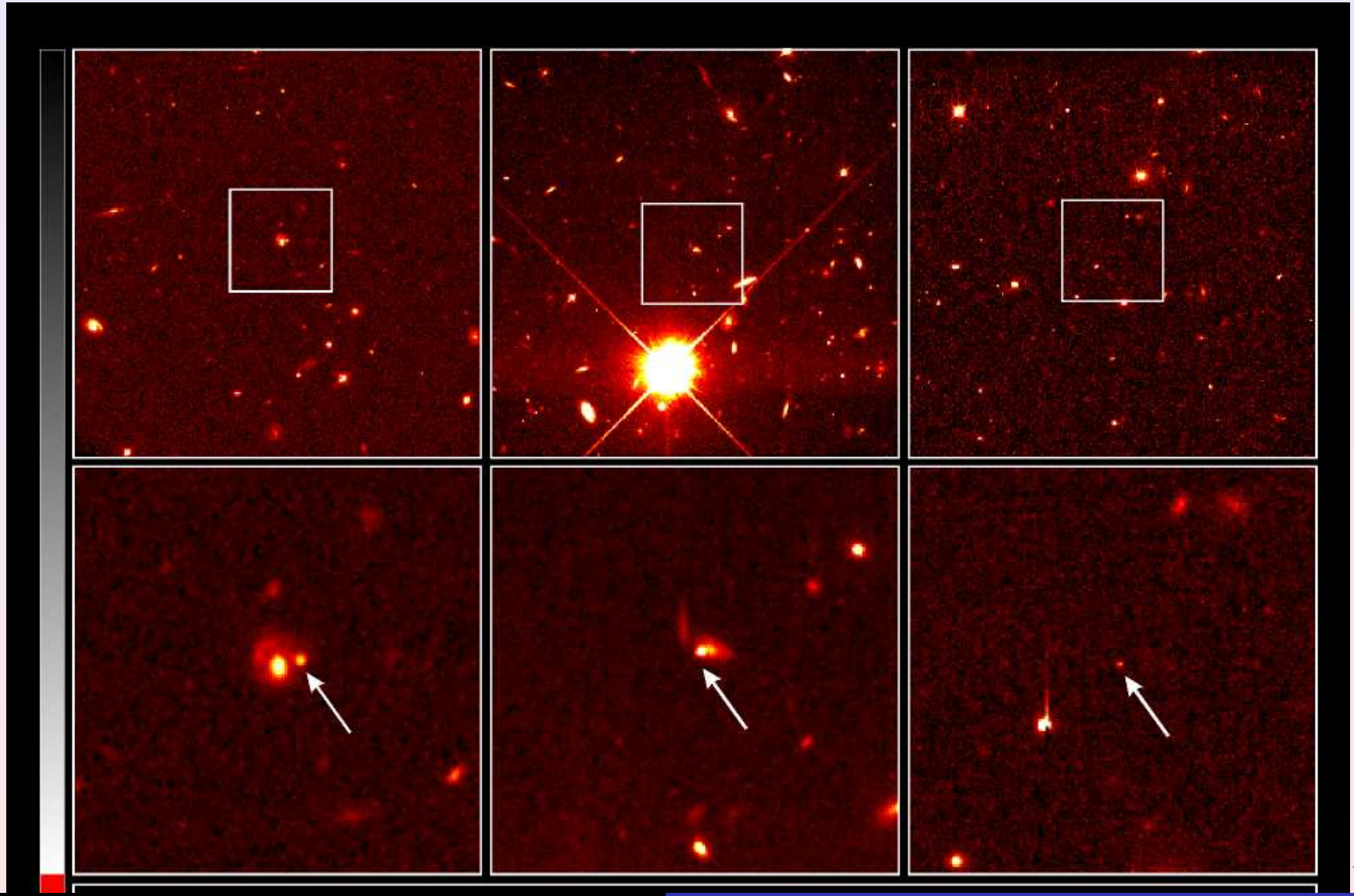

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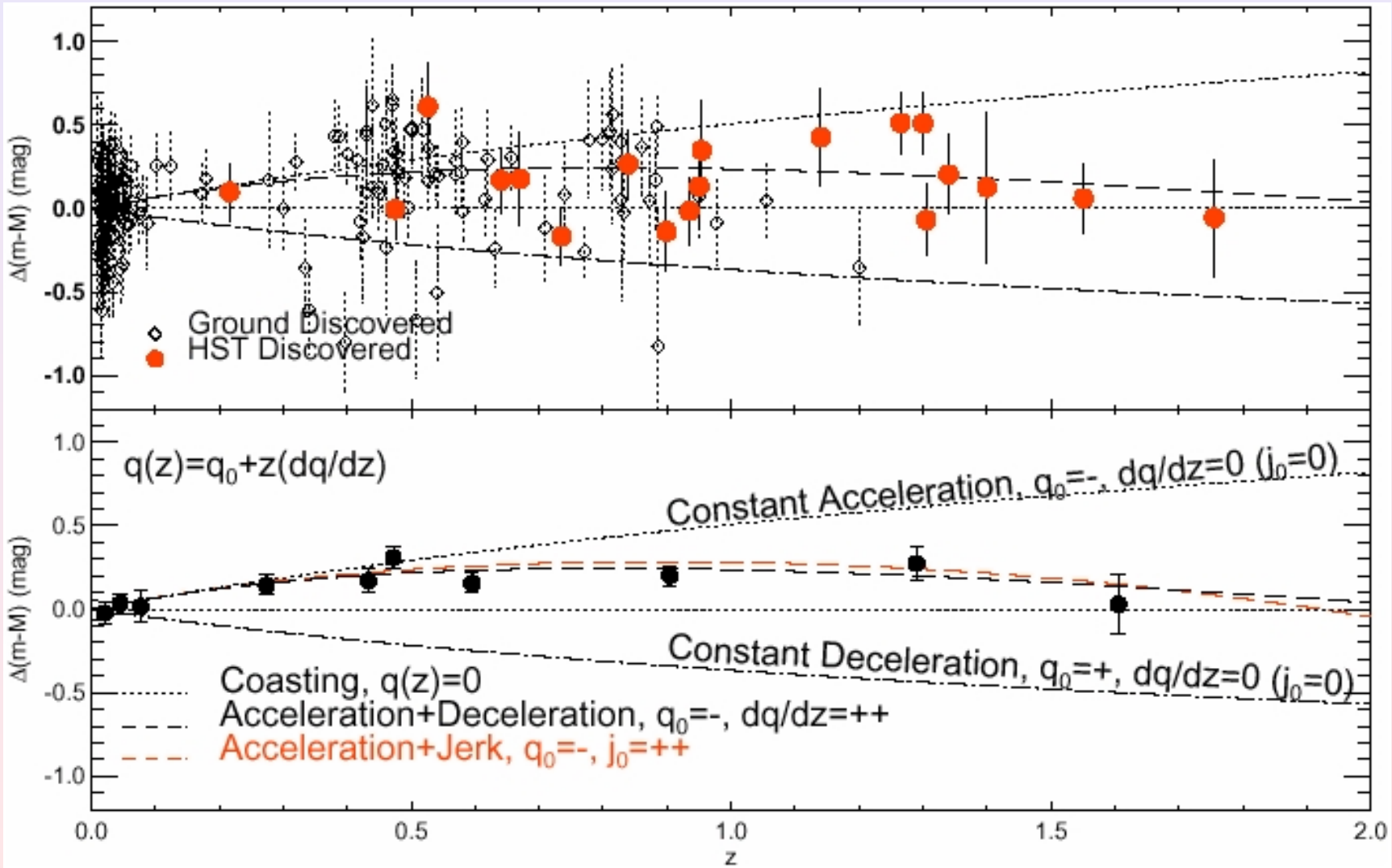
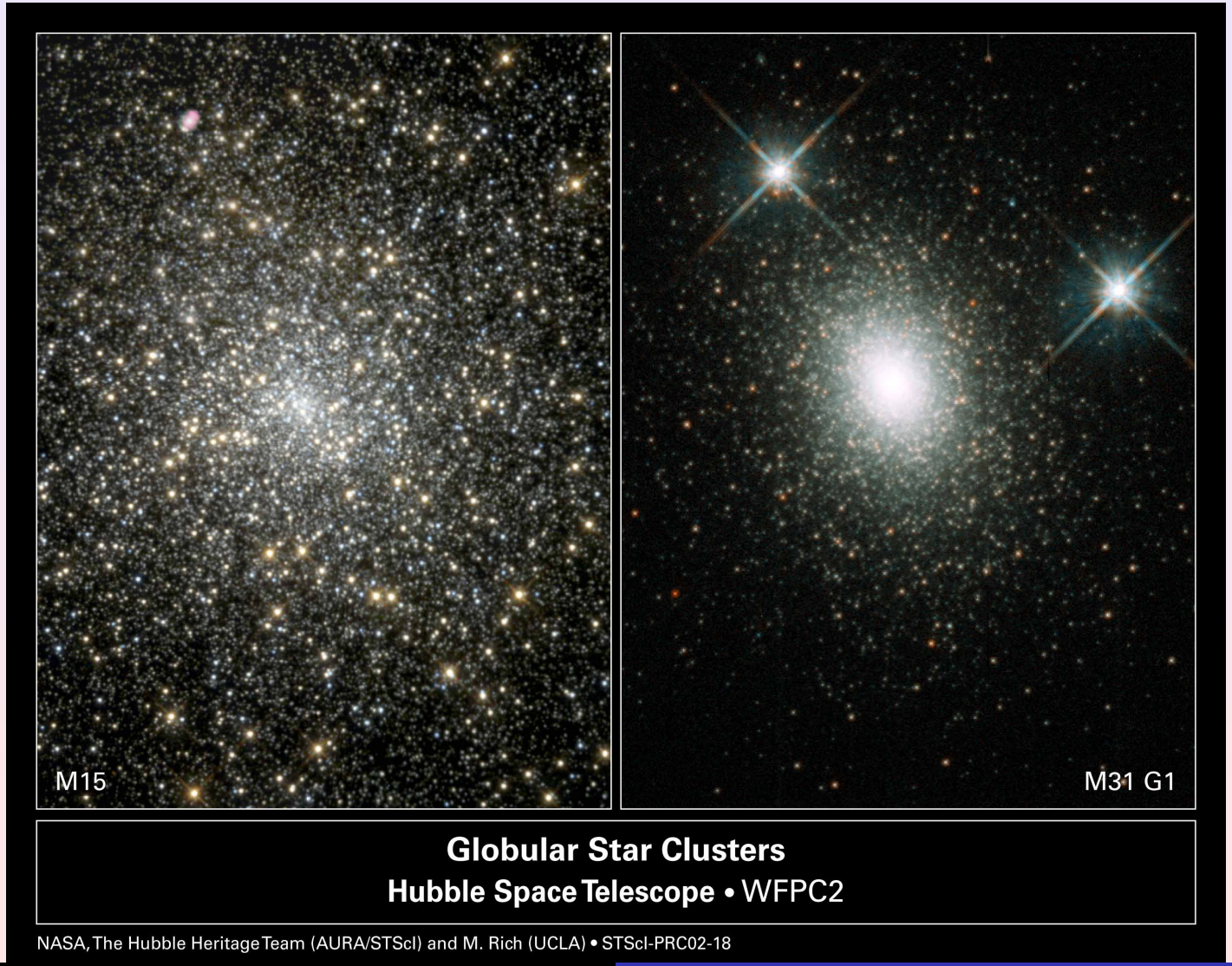


Supermassive Black Holes – AGNs:



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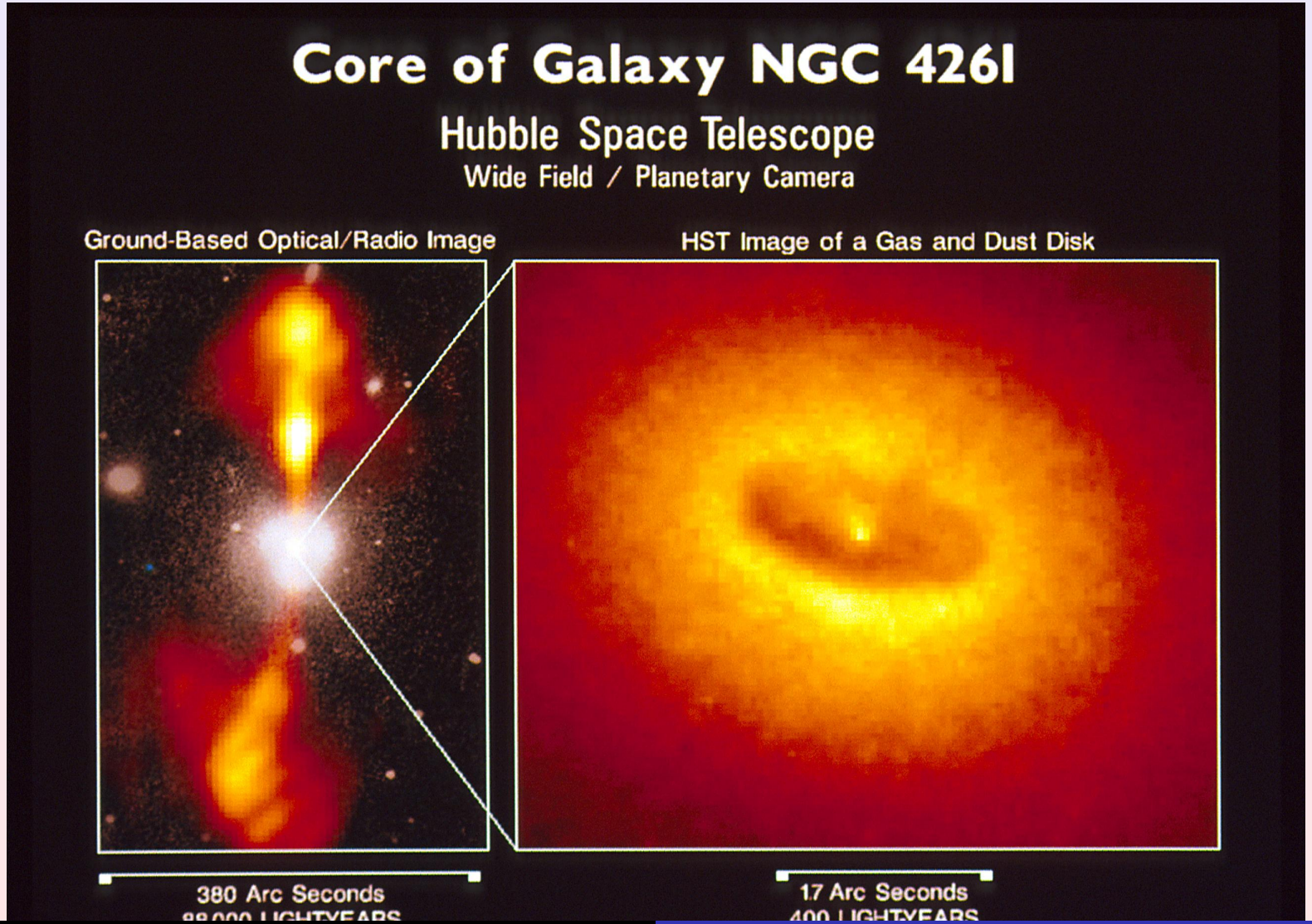
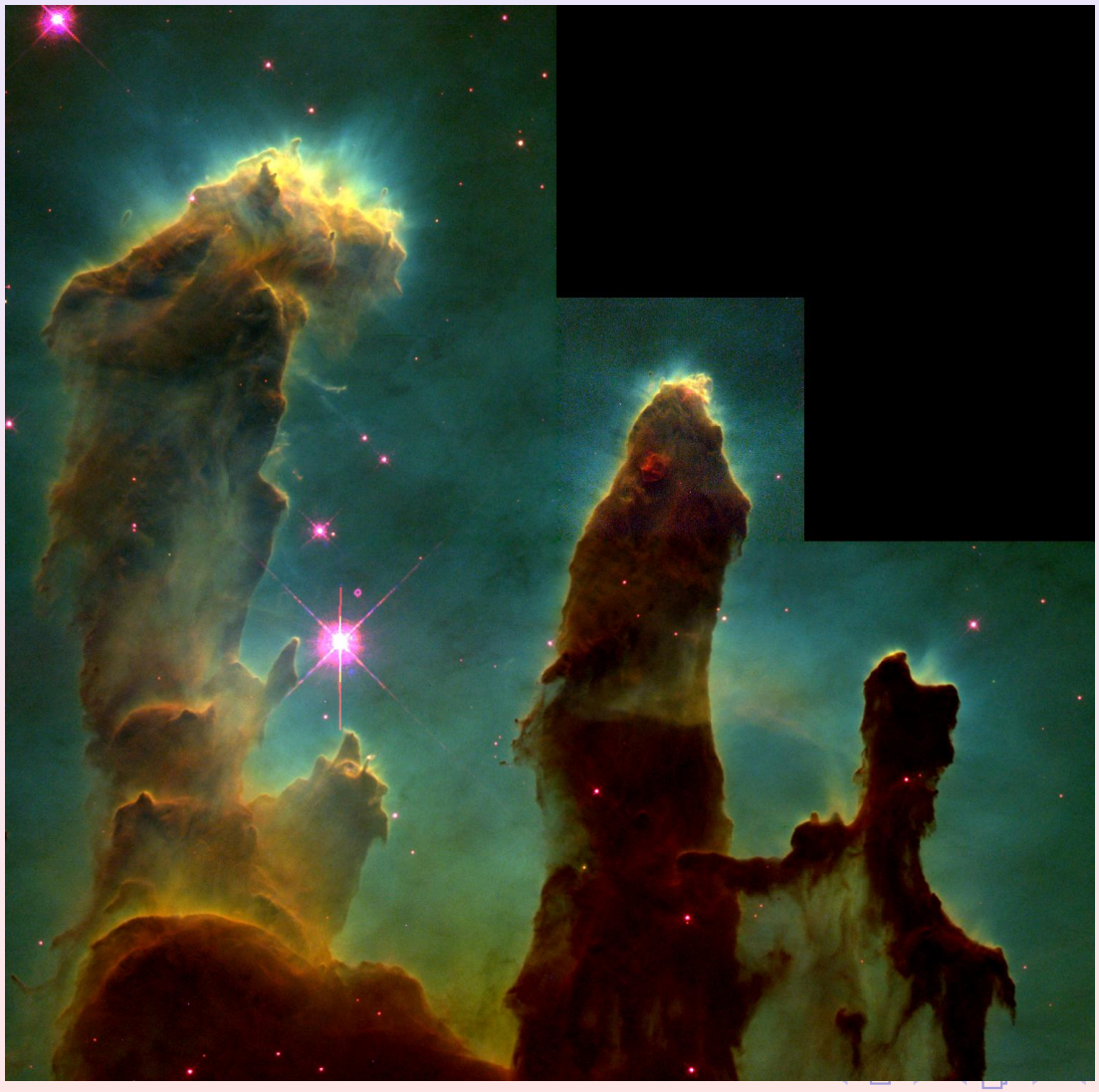
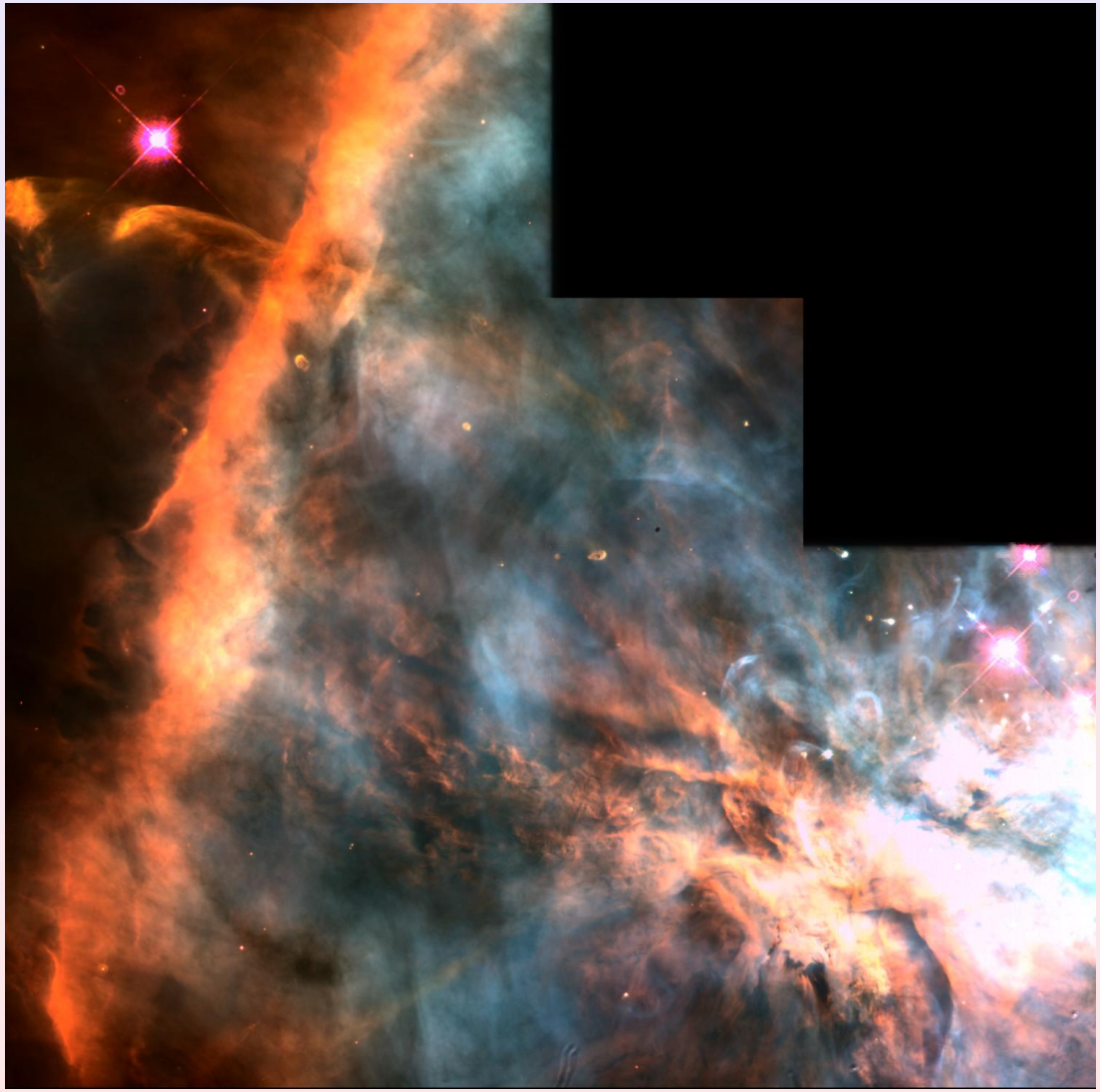


Star formation region in M16:



Protoplanetary disk observed in Orion neubula:



Death of stars – supernova remnants:

Others:

- first spectrograph of the atmosphere of an extrasolar planet, Osiris: envelope of hydrogen, carbon and oxygen around the planet that reaches $10,000^\circ$ C
- observation of host galaxies of Gamma-Ray-Bursts $\Rightarrow$ star-forming regions, favour SN connection

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- if not re-boosted, HST will re-enter atmosphere between 2010 and 2032

Adaptive optics improved ground telescopes:

HCG87 imaged by ESO's southern hemisphere telescope (left) and by the Hubble ST (right):

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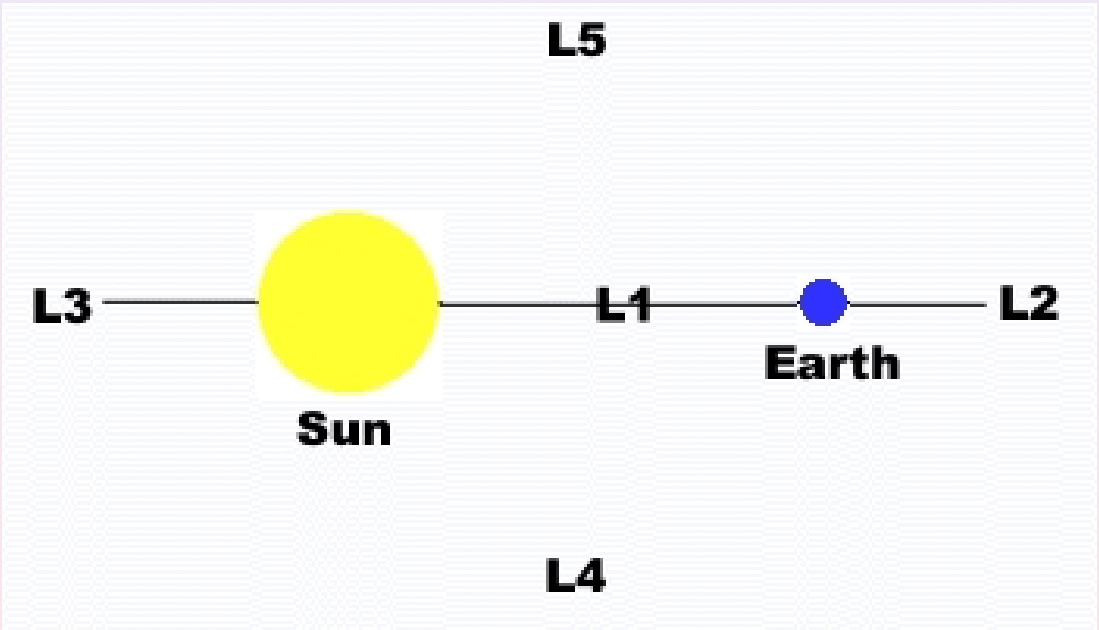

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- proposed launch date: no earlier than June 2013