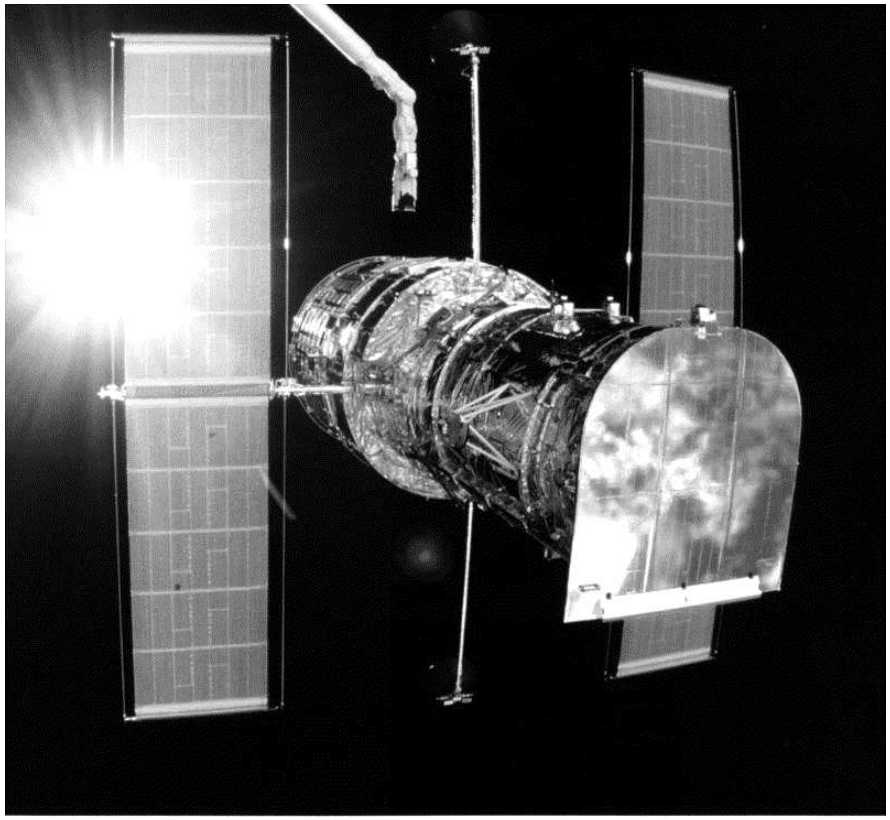
Lecture 15:Astronomy Picture of the Day



Hubble Space Telescope
600 km above Earth, launched in 1990
Fate in balance since last year

COMMENTARY

Congress Can Keep Our Eye on the Universe Open

By John Bahcall, Christopher McKee and Joseph Taylor,
John Bahcall is a professor of astrophysics at the Institute for Advanced Study at Princeton and recipient of the National Medal of Science. Christopher McKee is professor of physics and astronomy and

The president has crafted a budget that does not fund the long-planned final repair mission for the Hubble Space Telescope. Congress now faces a historic decision: If money is not restored to fix Hubble, then one of the world's most productive scientific instruments will forever close its eye on the universe. What is at stake is not only a piece of stellar technology but our commitment to the most fundamental human quest: understanding the cosmos. The Hubble telescope is a national asset, an inspiration to young scientists-in-the-making and an orbiting workhorse in the prime of its life. It has given us riveting, ravishing pictures of solar systems at birth, galaxies colliding and the death throes of a star in supernova. It has measured the rate of the universe's expansion, pinpointed the origins of gamma ray flashes, proved the existence of monster black holes and more. And yet, as staggering as such revelations have been over the last 15 years, Hubble's most important discoveries could be in the future.

Times Headlines

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TOP OF THE TIMES

LA Times Article today

Lecture 15: Announcements

- Reading article for Friday

LA Times Article of Wed Feb 2005

http://www.as.utexas.edu/~sj/a301-sp05.html

- Homework set 2 due on Mon Feb 28

- **Exam on Wed Mar 9**

Unravelling the Mysteries of the Universe Using Observations at Different Wavelengths from Different Telescopes

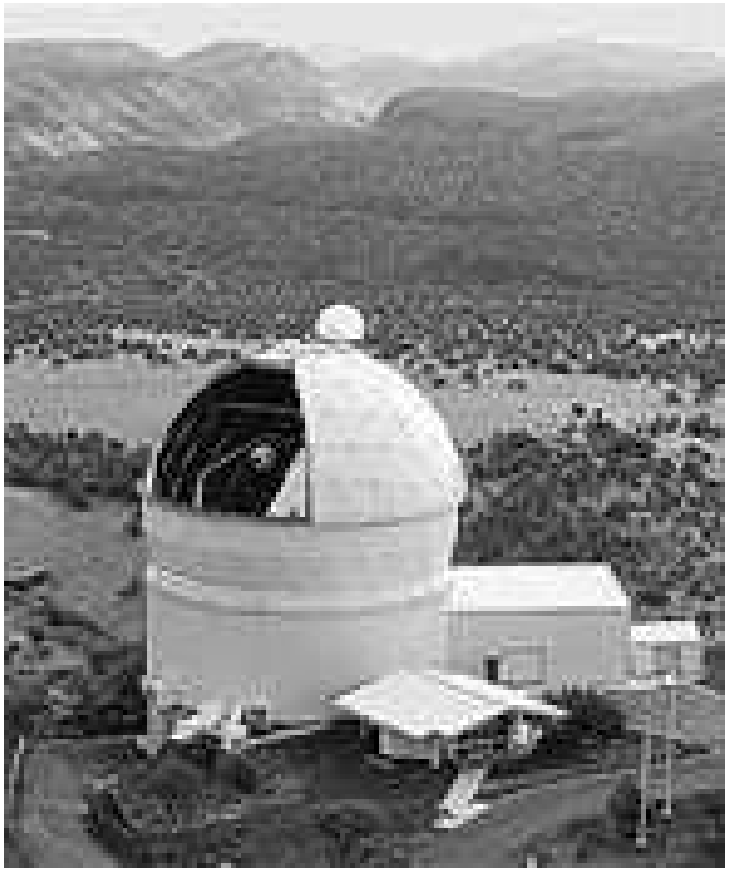
Telescopes and How They Work?

- See in-class notes

- What is a telecope? What kind of detectors are used at different λs?
- Why does size (collecting area) matter?
- Why do we need space-based telescopes?
- What controls the angular resolution of a telescope
- Why do stars twinkle?

Largest Optical and Infrared Telescopes

Keck 10-m telescope at 5000 feet on Mauna Kea in Hawaii

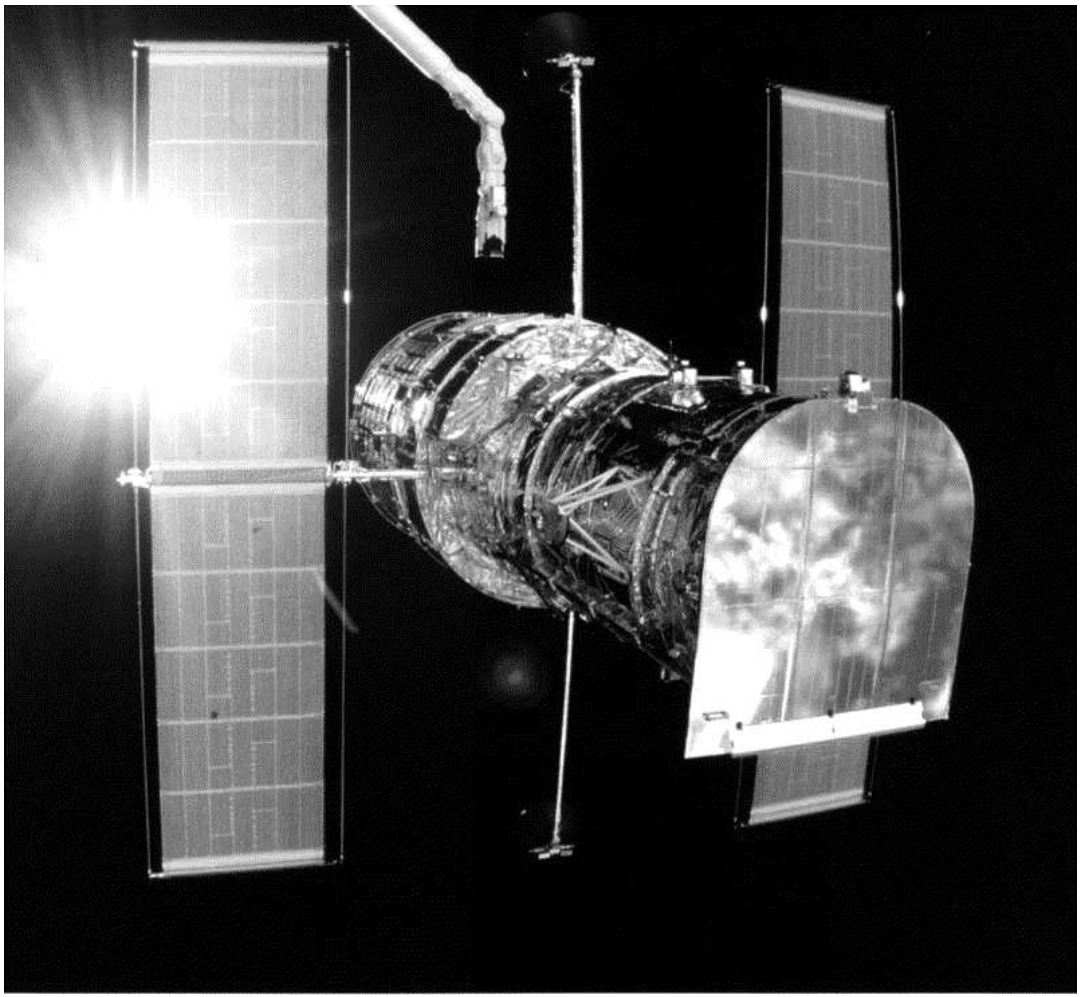


9.2m Hobby Eberly Telescope of UT Austin at the Mac Donald Observatory

Largest Optical and Infrared Telescopes

Concrete base, 40 ft diameter, that supports the 9.2m Hobby Eberly Telescope

Hubble Space Telescope (HST)



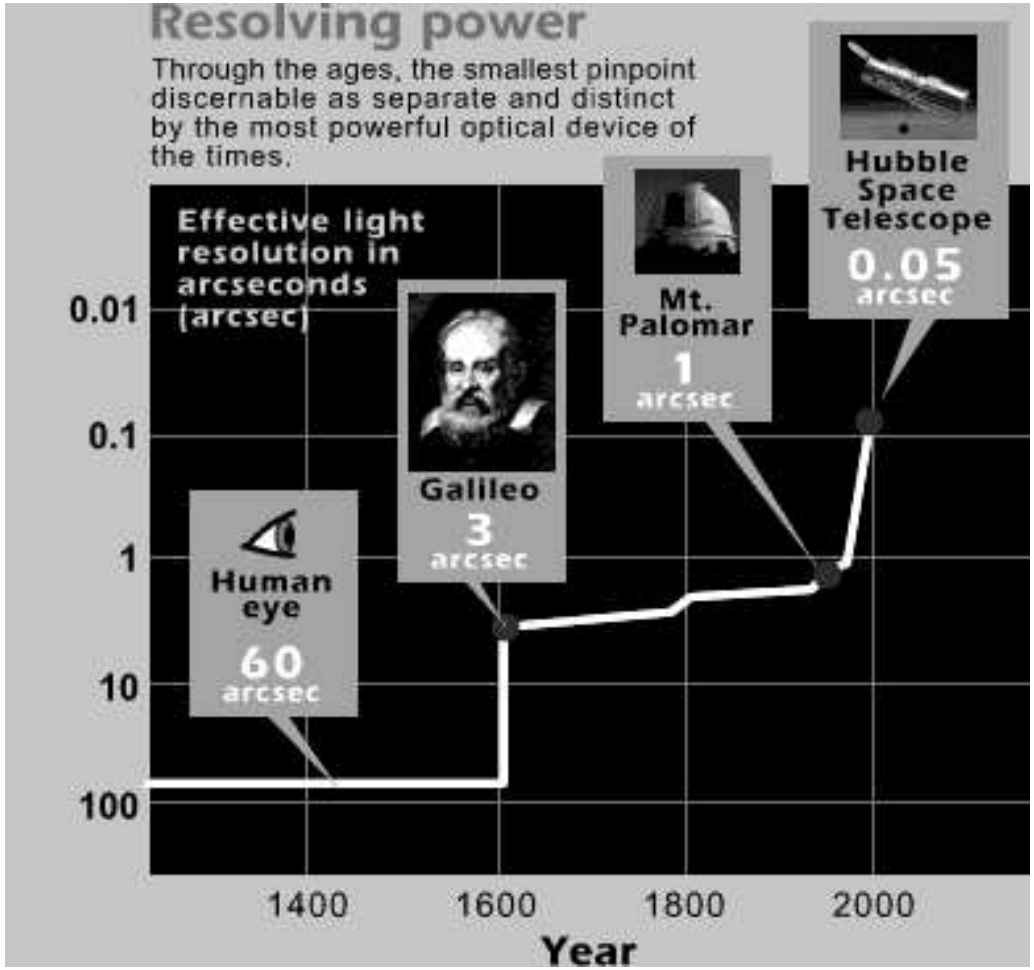
- Launched in 1990
- Mirror diameter= 2.5-m
- Orbits 600 km above Earth
- Powered by solar batteries
- Instruments on board :
  uv, optical, infrared

à No blurring by Earths's atmosphere à high spatial resolution.

à Can observe UV photons without absorption by E's atmosphere

à Can observe infrared emission without high background (glare) from sky

Resolving Power of Telescopes



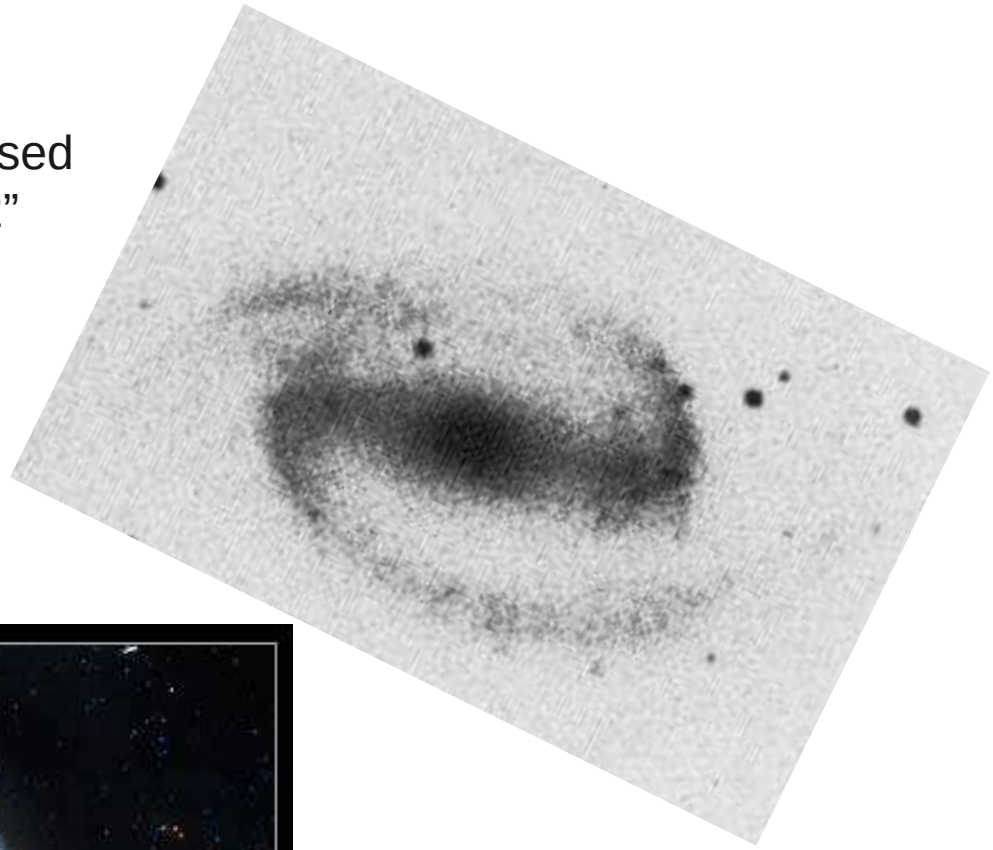
- Angular resolution of ground-based telescopes is limited by the "seeing" of the Earth's atmosphere, i.e, by turbulence

- Ground-based optical seeing >= 0.5"

- Hubble Space Telecope has an angular resolution ~ 0.05" at optical wavelengths !

Resolving Power of Telescopes

NGC 1300 : ground-based image with seeing ~ 2”

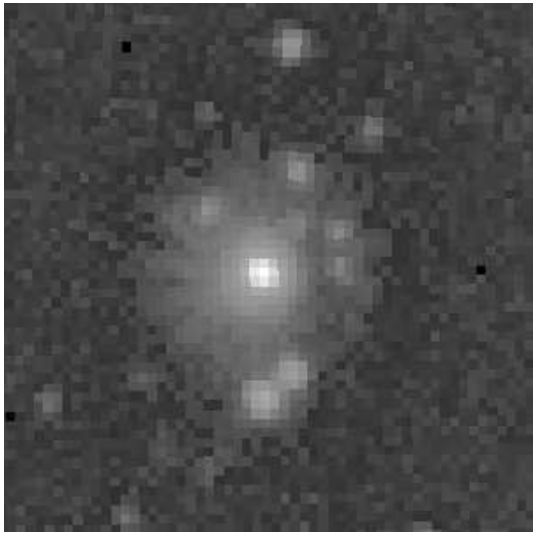


NGC 1300 HST image with seeing ~ 0.05”

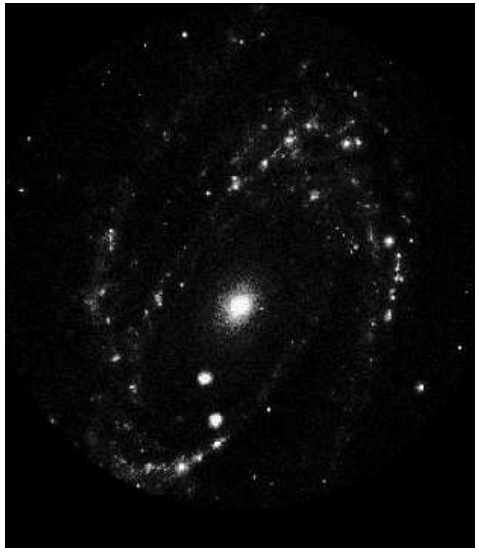
Resolving Power of Telescopes

HST image of spiral galaxy pair: seeing ~ 0.05”

Multi-Wavelength view of M81



X-ray/ROSAT

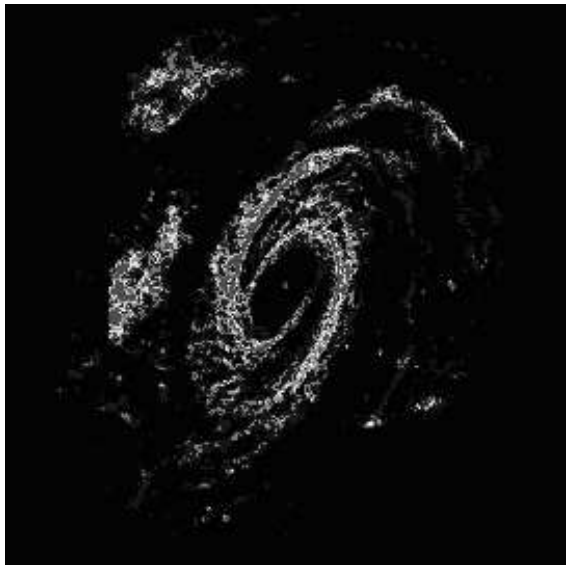


Ultraviolet/ASTR0-1

Visible light

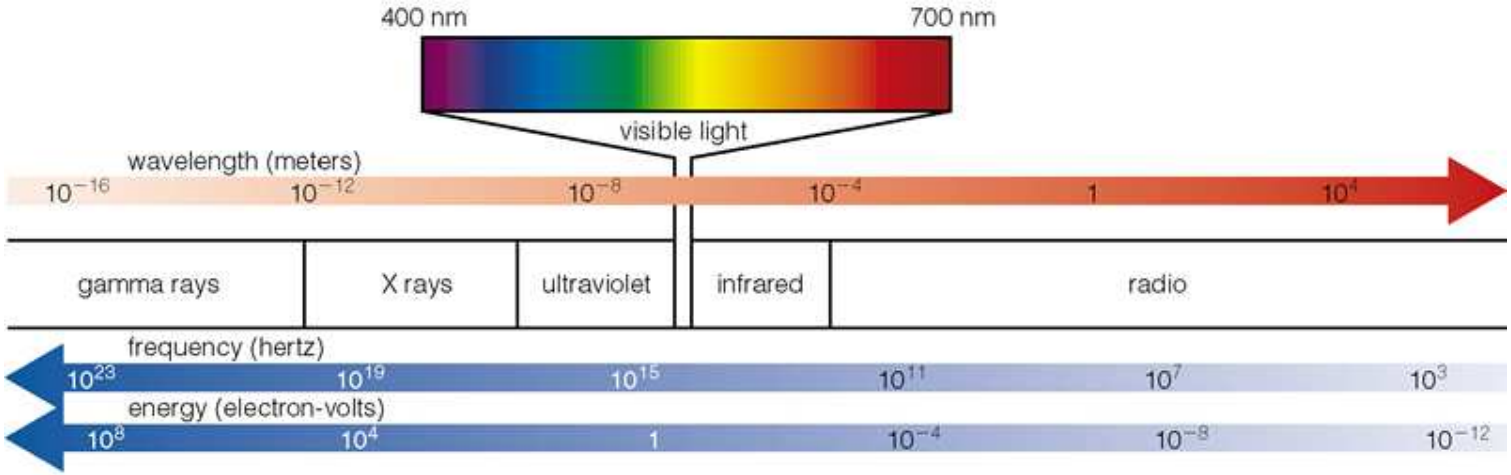
Near infrared/Spitzer

Far-infrared/Spitzer



Radio 21cm/VLA

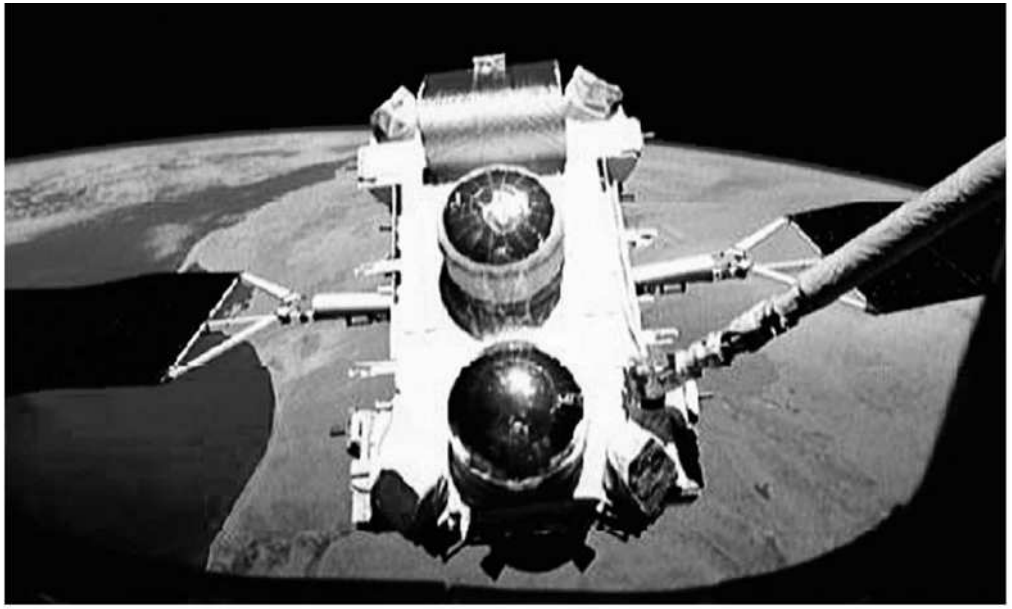
Different Wavelengths Trace Different Phenomena/Objects



- See in-class notes

- What do we learn from X-ray, ultraviolet, visible, infrared, and radio λs?
- Is the Earth's atmosphere transparent to these λs?
- What telescopes are used to observe these λs?

Gamma-Ray Observatories



- Compton Gamma- Ray Observatory
- Deployed from Space Shuttle in1991
- 17 tons!

- NASA's Swift Gamma Ray Burst Explorer launced Nov 2004
- Last week: reported the brightest flash of light ever detected from beyond the solar system: more energy than the sun emits every 150,000 years!!!

à Gamma Ray Burst from a distant neutron star