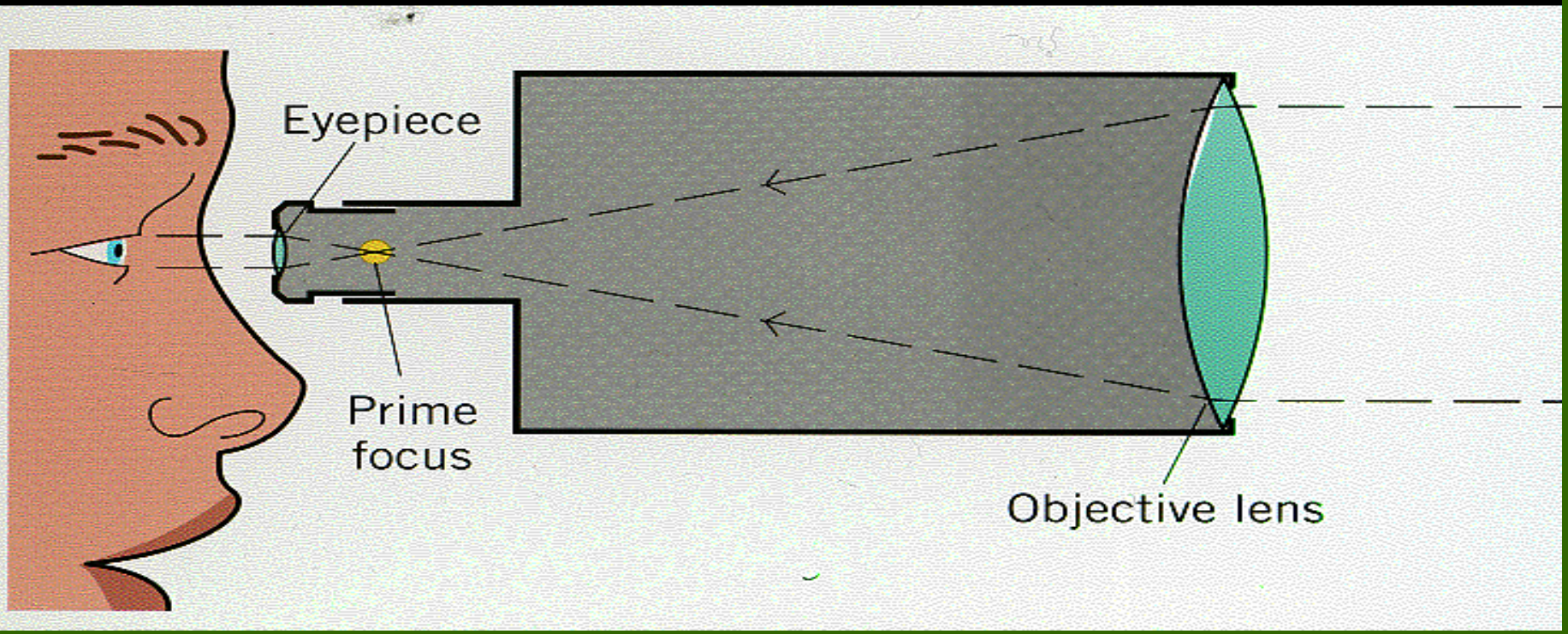
eyes on the sky

TELESCOPES

- what does a telescope look like ?


Eyepiece
Prime
focus
Objective lens

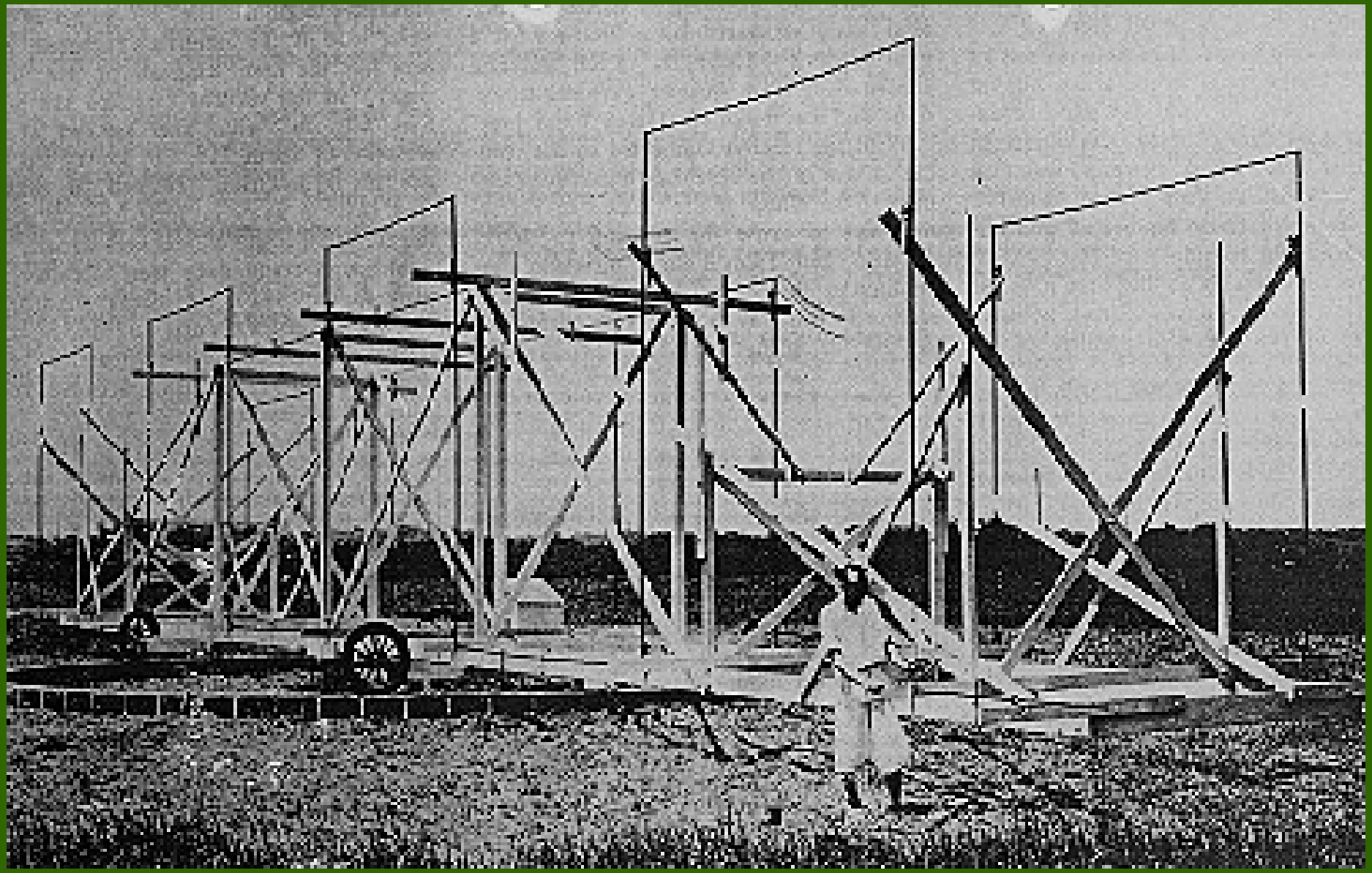
Isaac Newton Telescope

La Palma

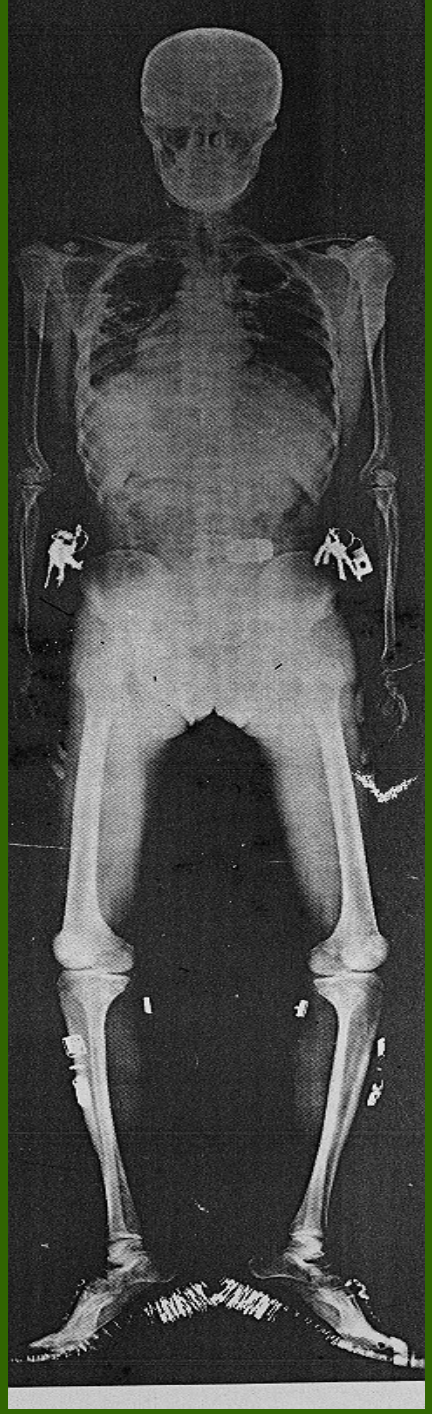
2.5m aperture

Westerbork radio dish

First ever radio telescope

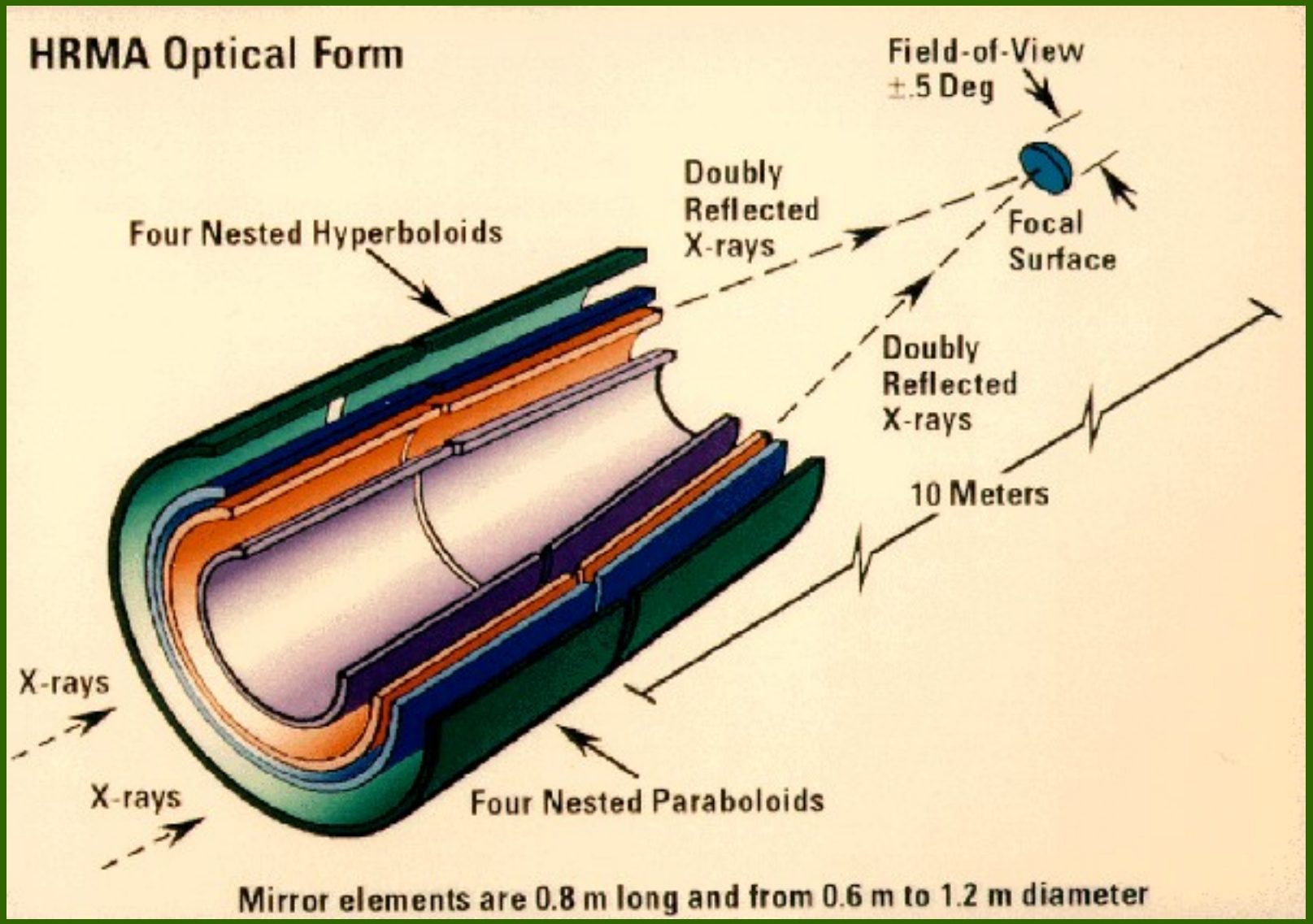


AXAF X-ray telescope

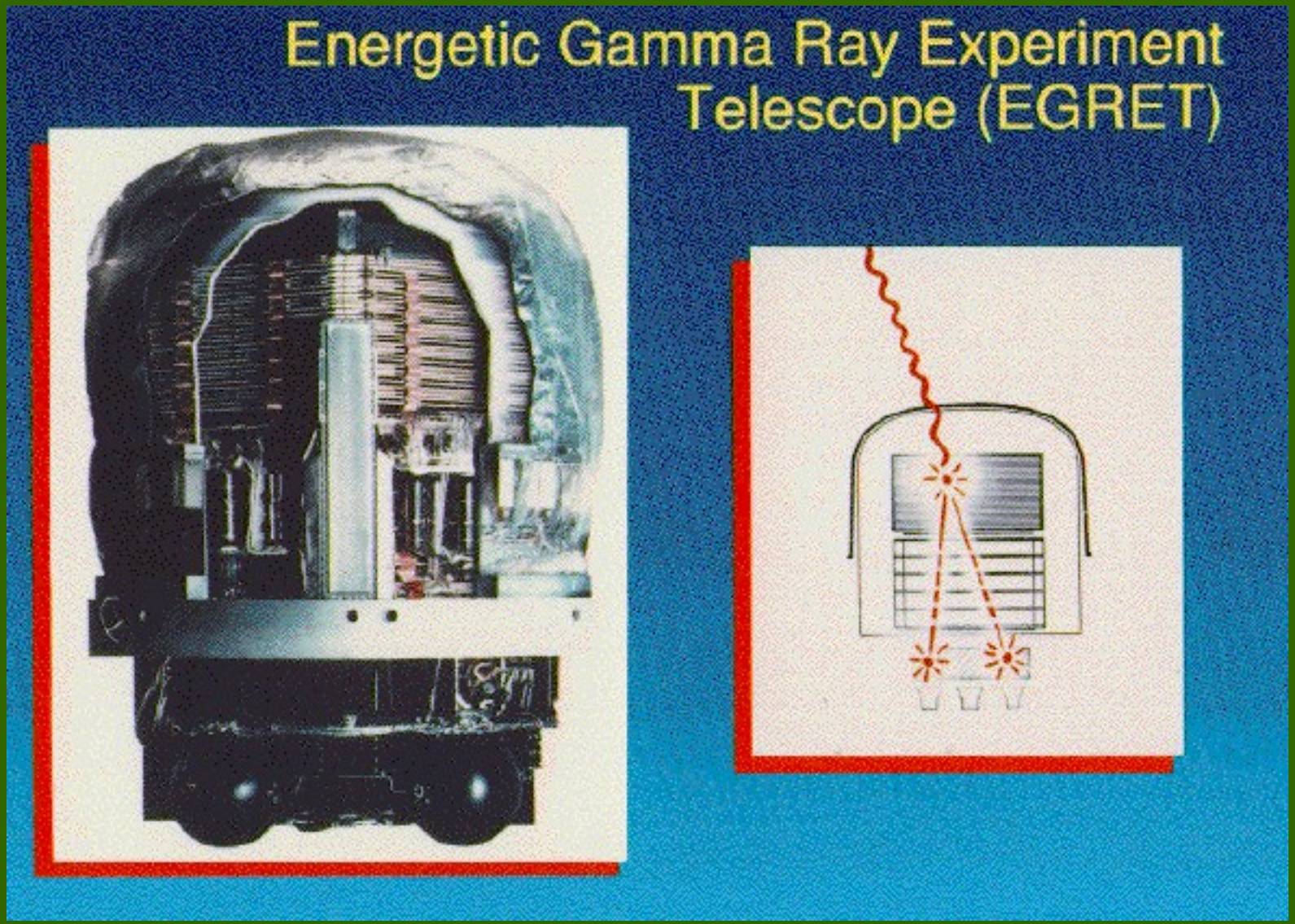


X-rays pass through most things

X-ray mirrors are hollow tubes...



EGRET γ-ray telescope



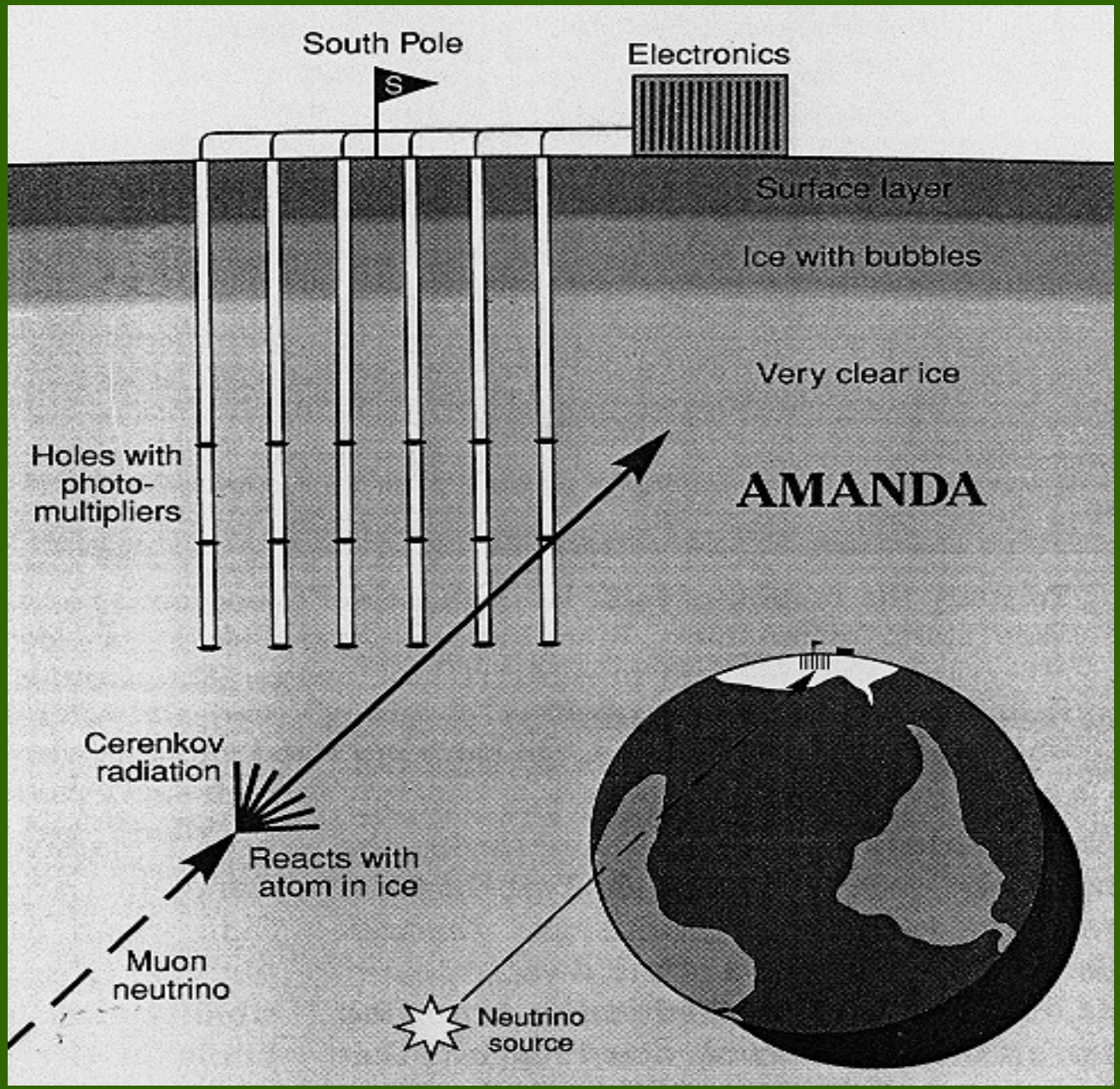
HEGRA cosmic-ray telescope


telescope


telescope
camera

AMANDA neutrino telescope

McMurdo base, South Pole



AMANDA neutrino telescope

The Universe as a telescope

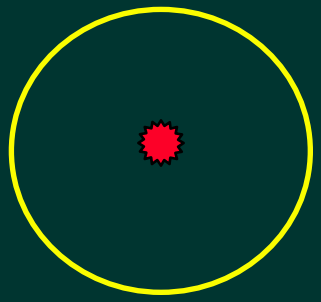
Gravitational Lens in Abell 2218

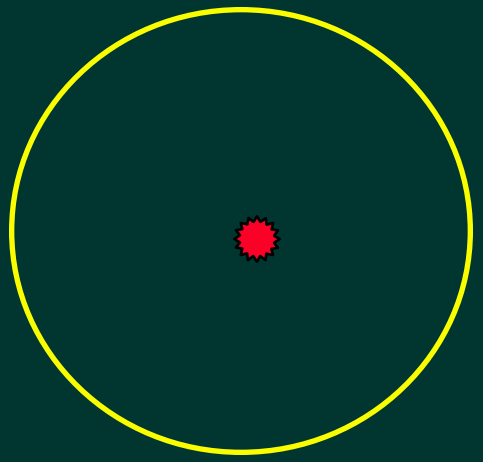
HST · WFPC2

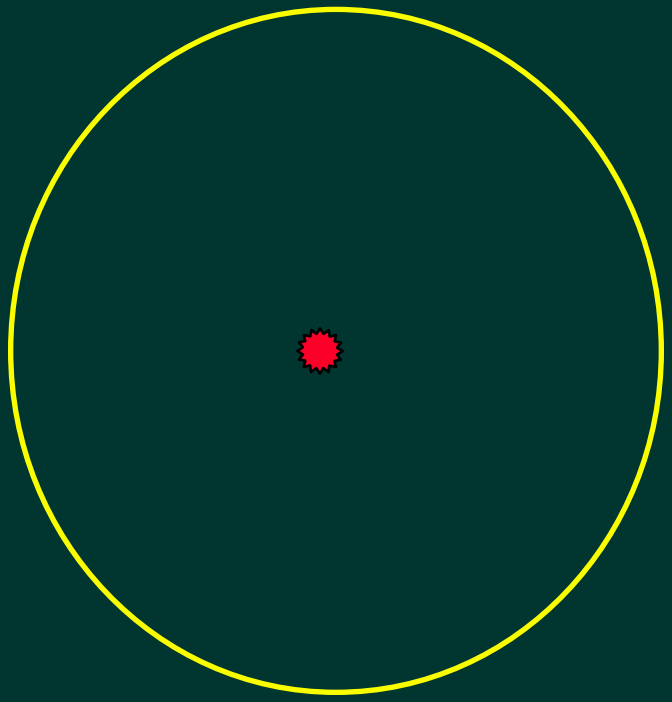
PF95-14 · ST ScI OPO · April 5, 1995 · W. Couch (UNSW), NASA

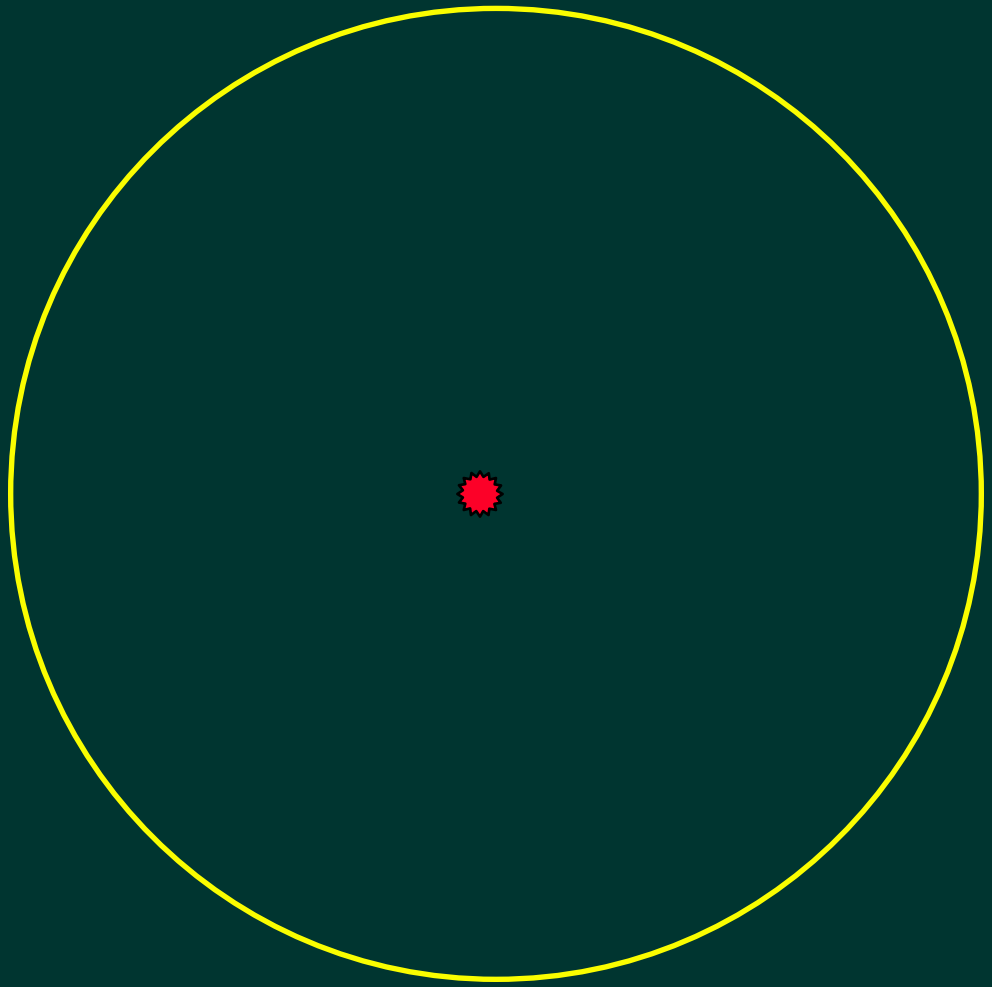
Why is bigger better ?

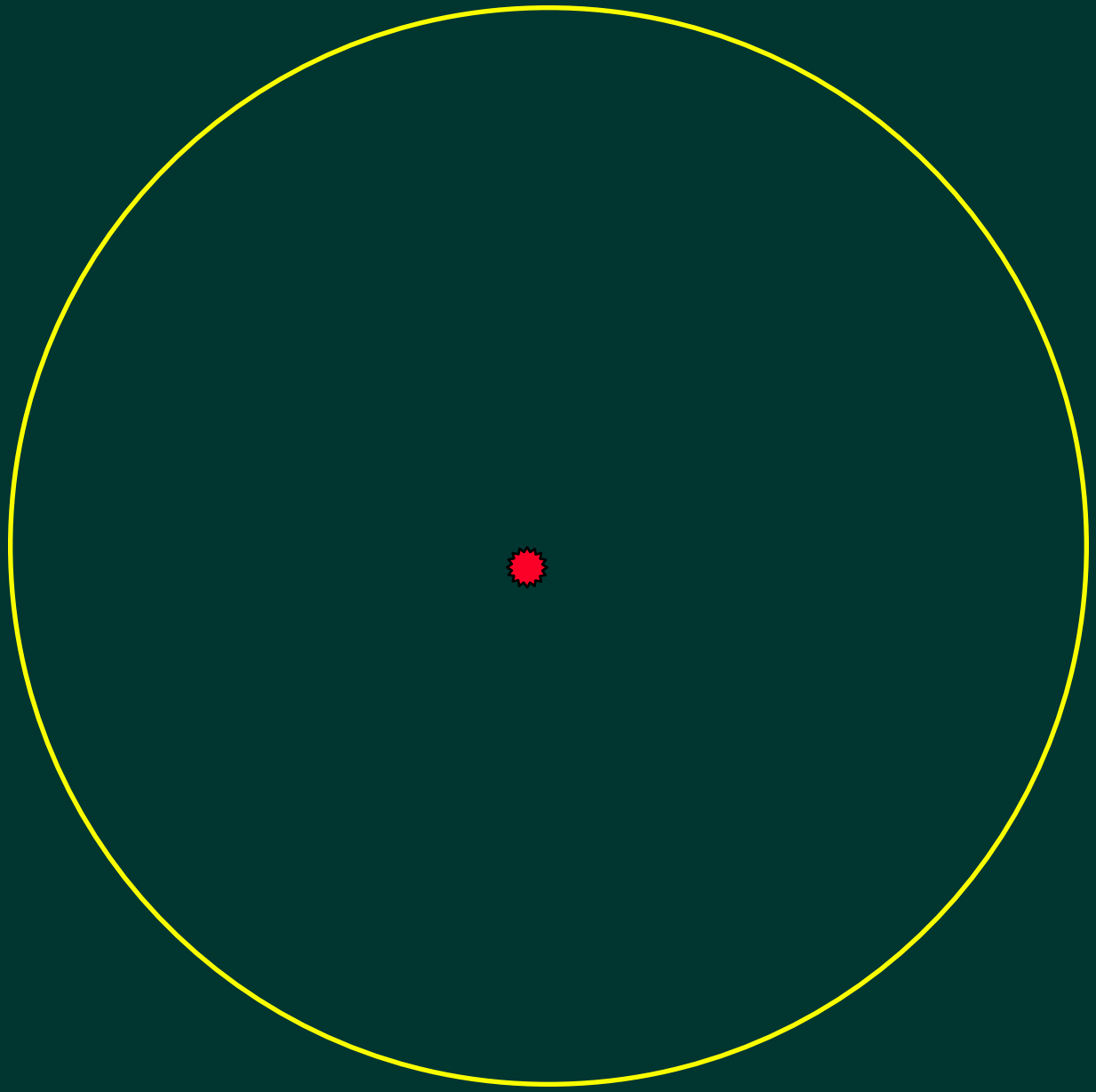
- **Terrestrial applications :**
  magnification
- **Astronomical applications :**
  catch more light ....
  sharper pictures ...

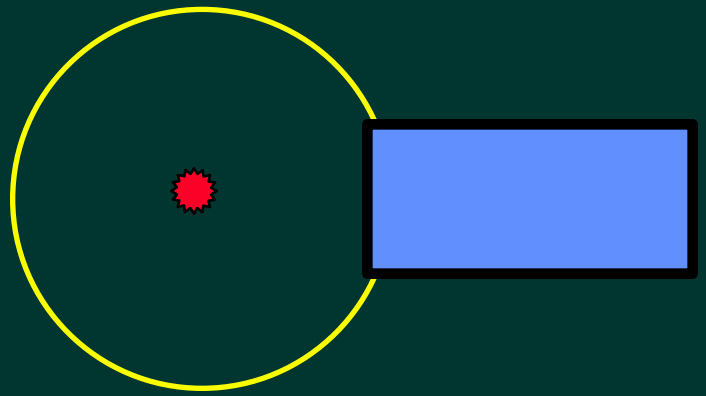


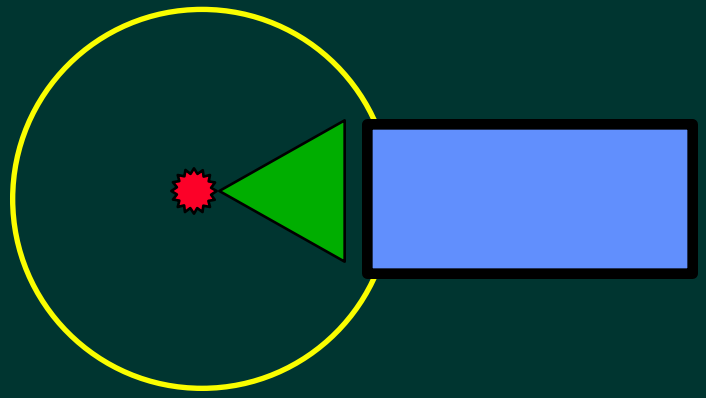


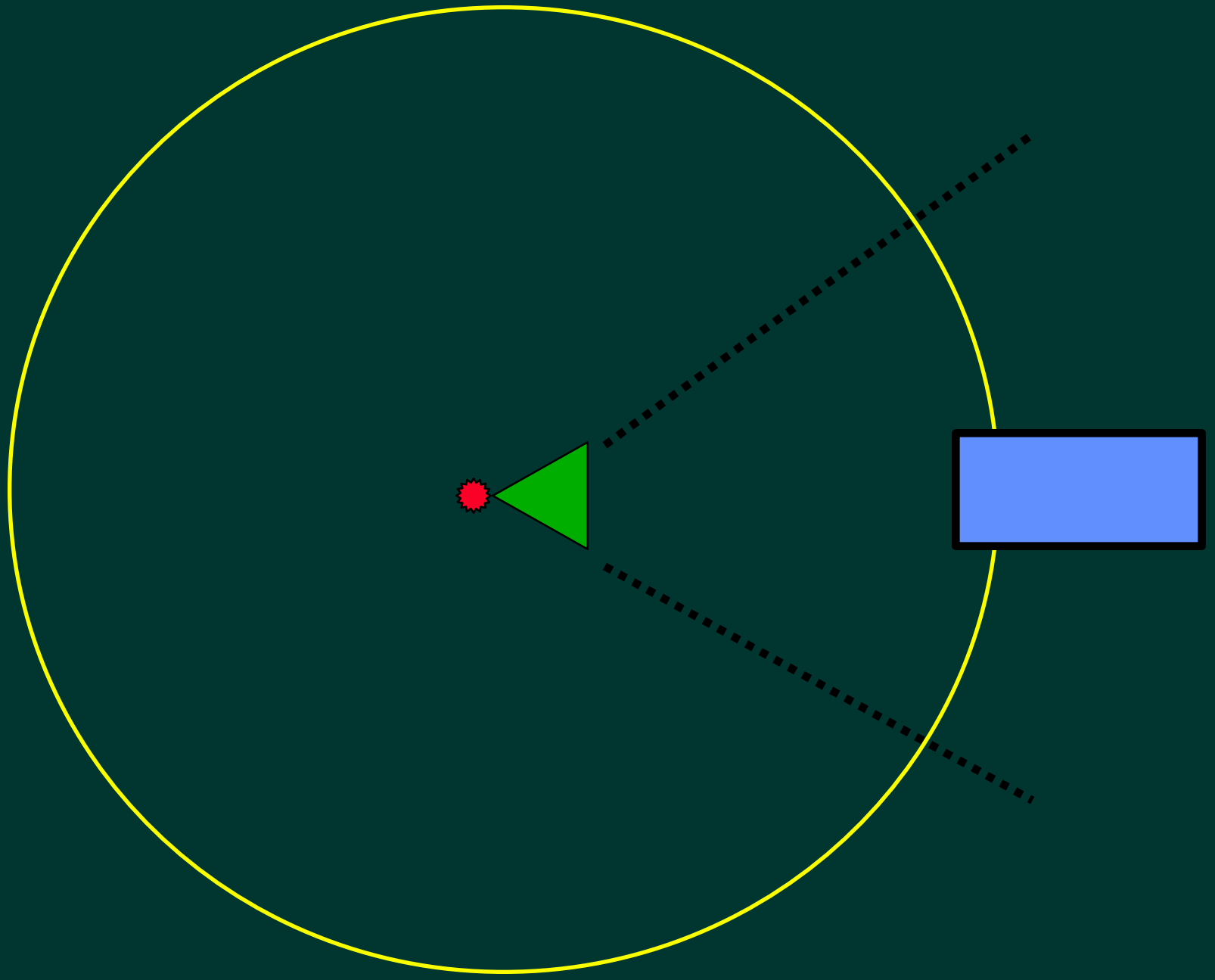


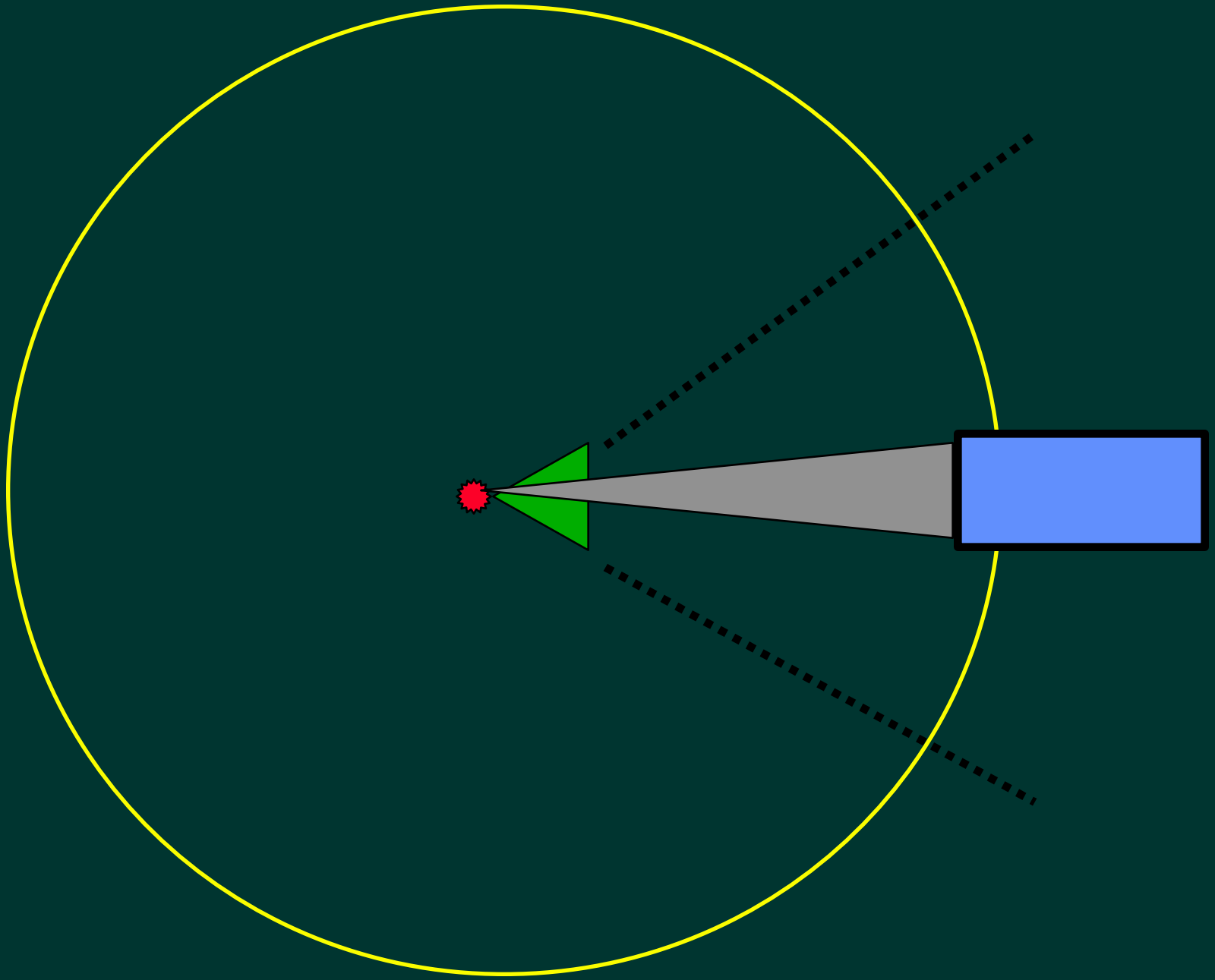


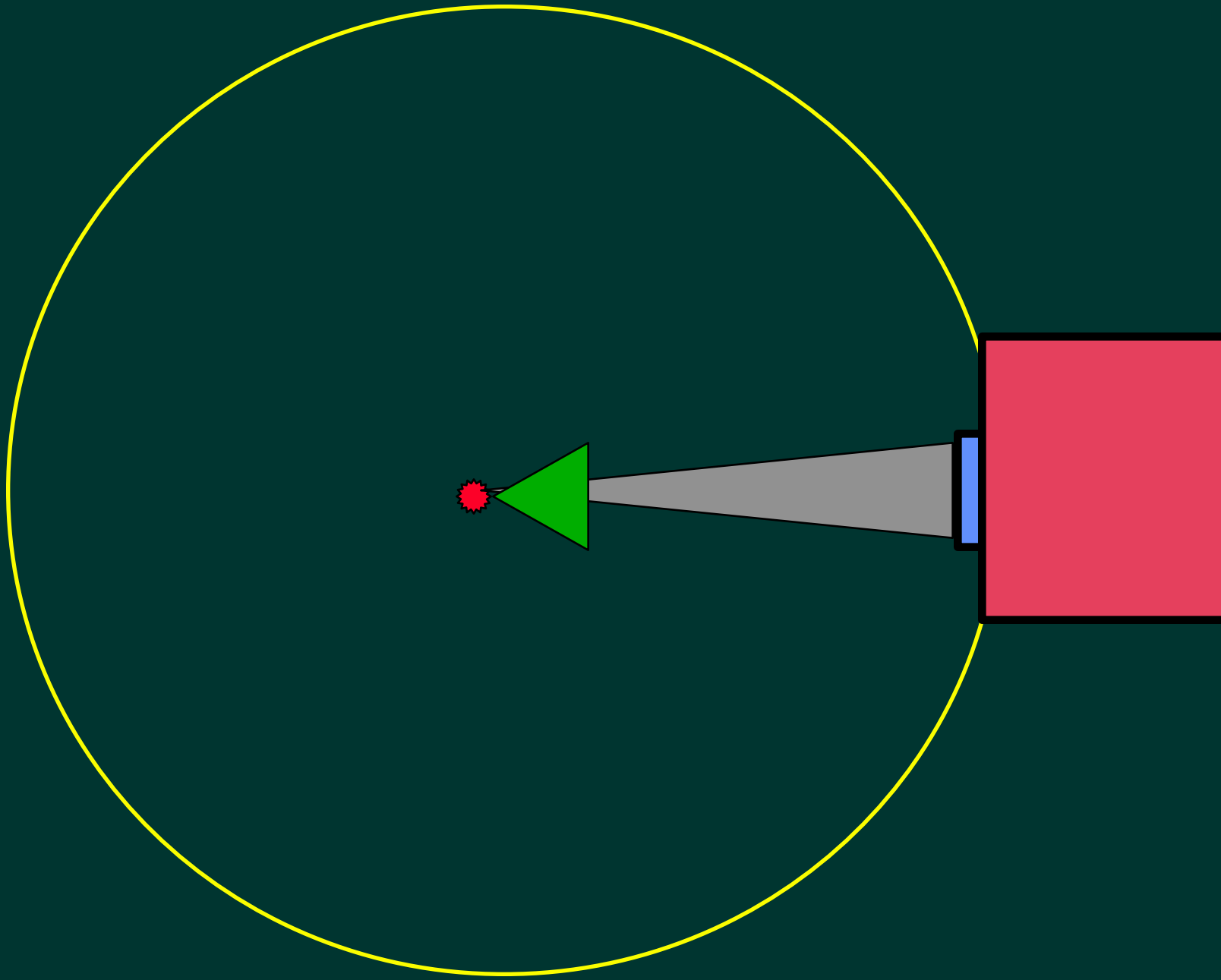












Bigger is better

- naked eye (6mm)
  m=6, few thousand local stars
- 8 inch amateur teslecope
  m=12, nebulae, bright galaxies
- 1m professional telescope
  m=20, millions of faint galaxies
- 10m new generation telescope
  m=28, edge of universe

Isaac Newton Telescope (2.5m)

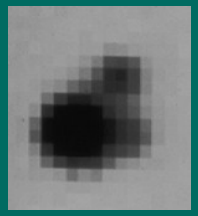
William Herschel Telescope Dome (4.2m)

Gemini 8m mirror blank

Gemini North (Hawaii) Feb 27th 1998

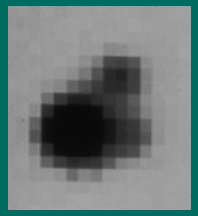
sharpness versus magnification….

sharpness versus magnification....

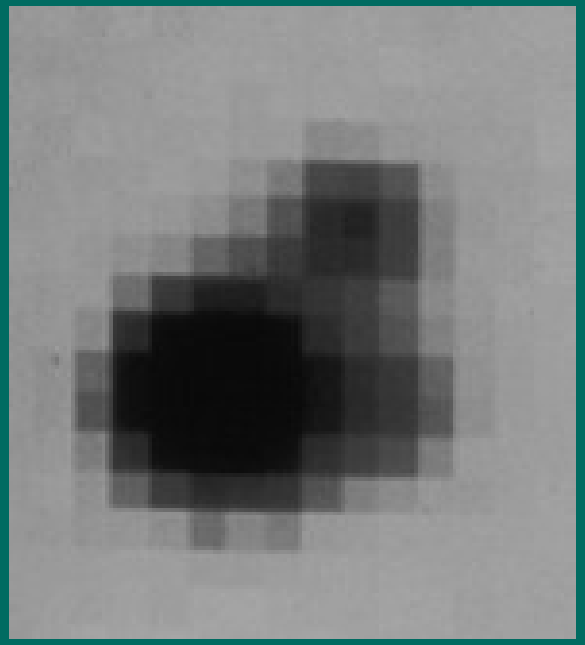


blurred picture

sharpness versus magnification….

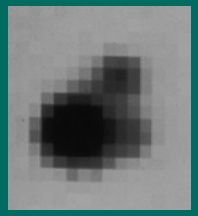


blurred picture

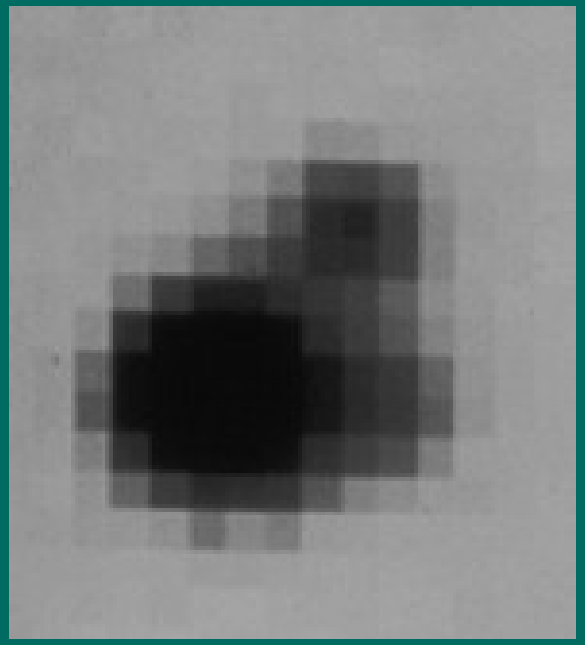


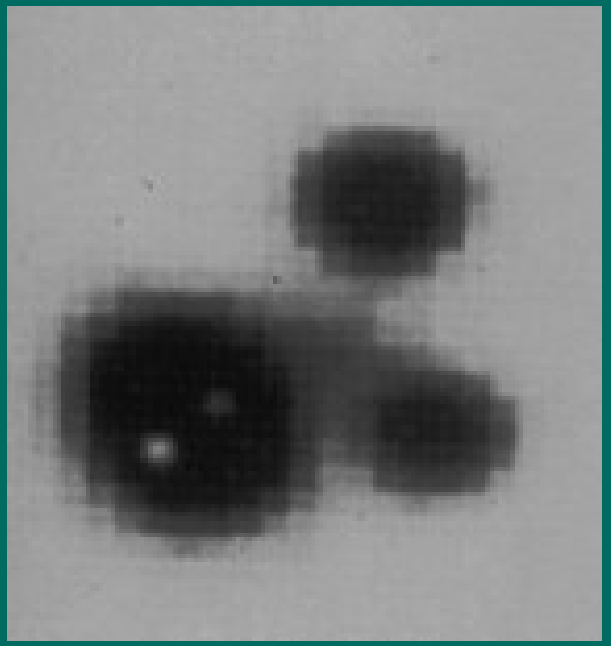
magnified blurred picture

sharpness versus magnification….



blurred picture





sharper picture

blurring by diffraction

- **long wavelengths are more blurred**
- **==> problem for radio astronomy**

- **small telescopes blur worse**
- **==>radio astronomers want BIG TELESCOPES to get sharp pictures**

very
fuzzy
pictures

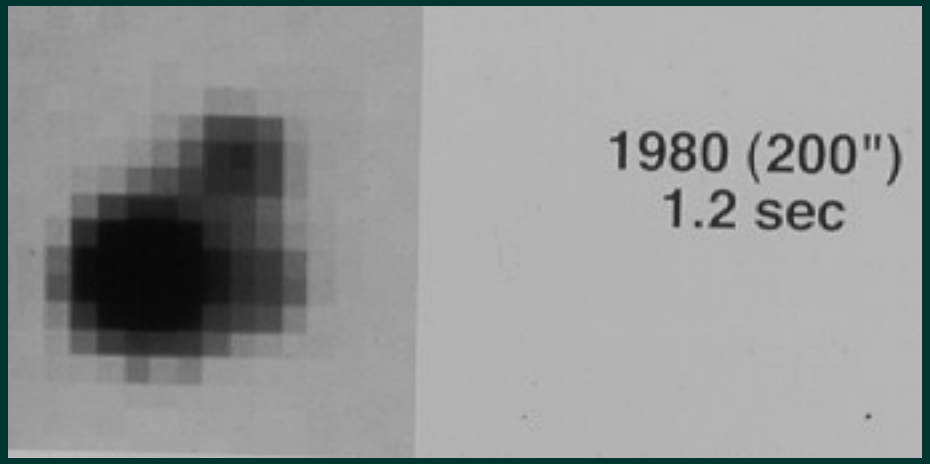
sharper than Hubble Space telescope

blurring by the atmosphere

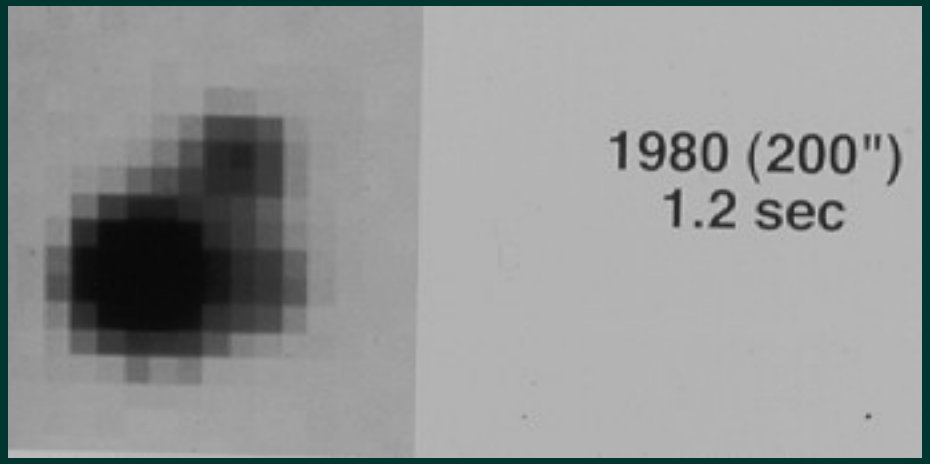
- visible light is blurred by turbulent air
- ==> big telescopes don't help !
- solution is to get above the atmosphere ....

Hubble Space Telescope launch

Hubble Space Telescope above the Earth

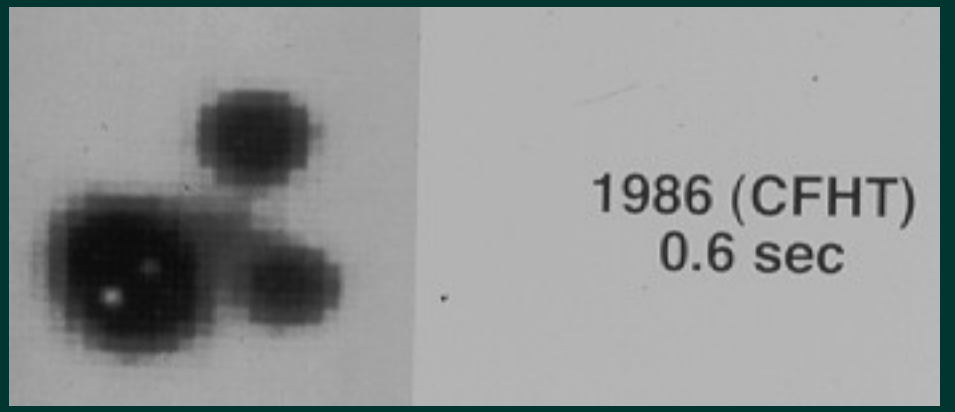


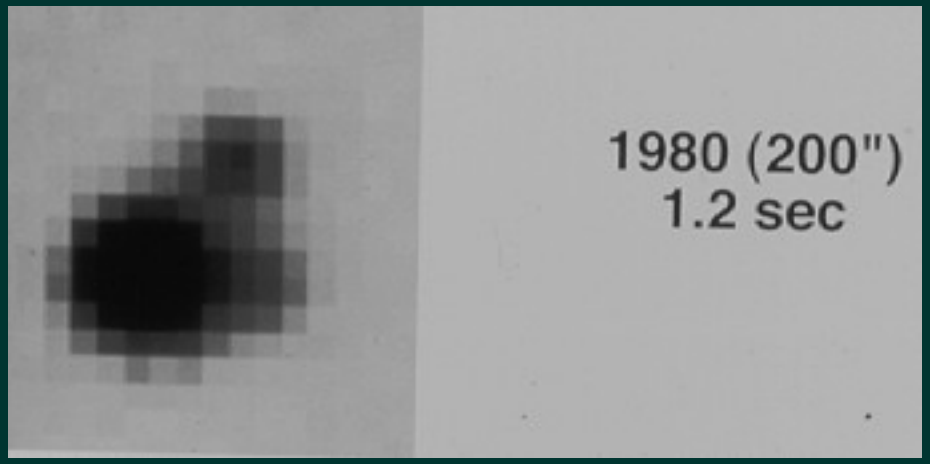
Palomar on a night with good seeing



Palomar on a night with good seeing

Hawaii on a night with unnusually good seeing





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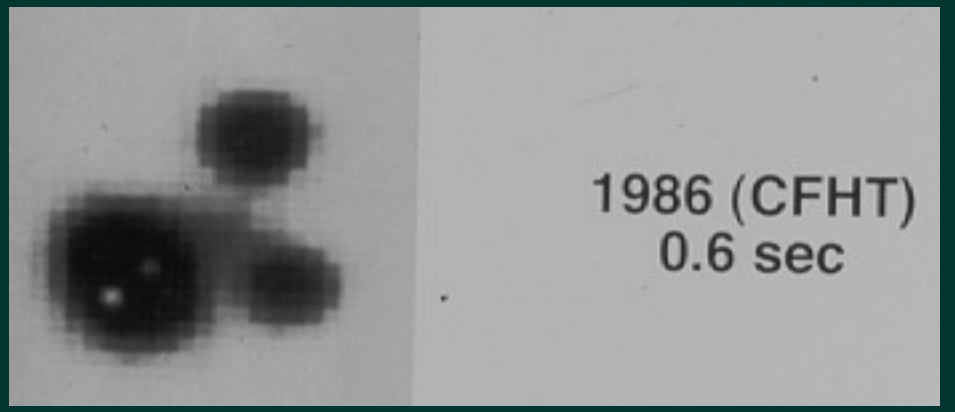
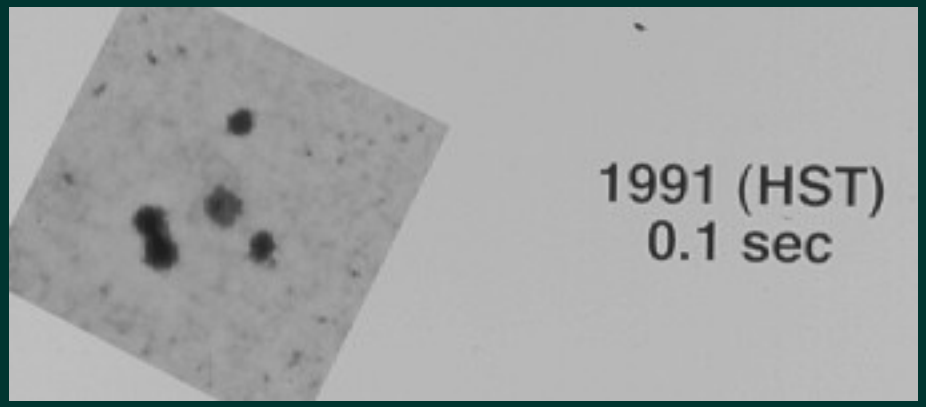




Space Telescope EVERY night

blurring by the atmosphere
Part II

- new technique : “Adaptive Optics”
- .....track wobbling of bright star
- .... wobble optics to correct the distortion
- ==> sharp pictures from the ground

making a fake bright star by laser...

The hard life of the struggling astronomer

...long arduous flights to Honolulu...

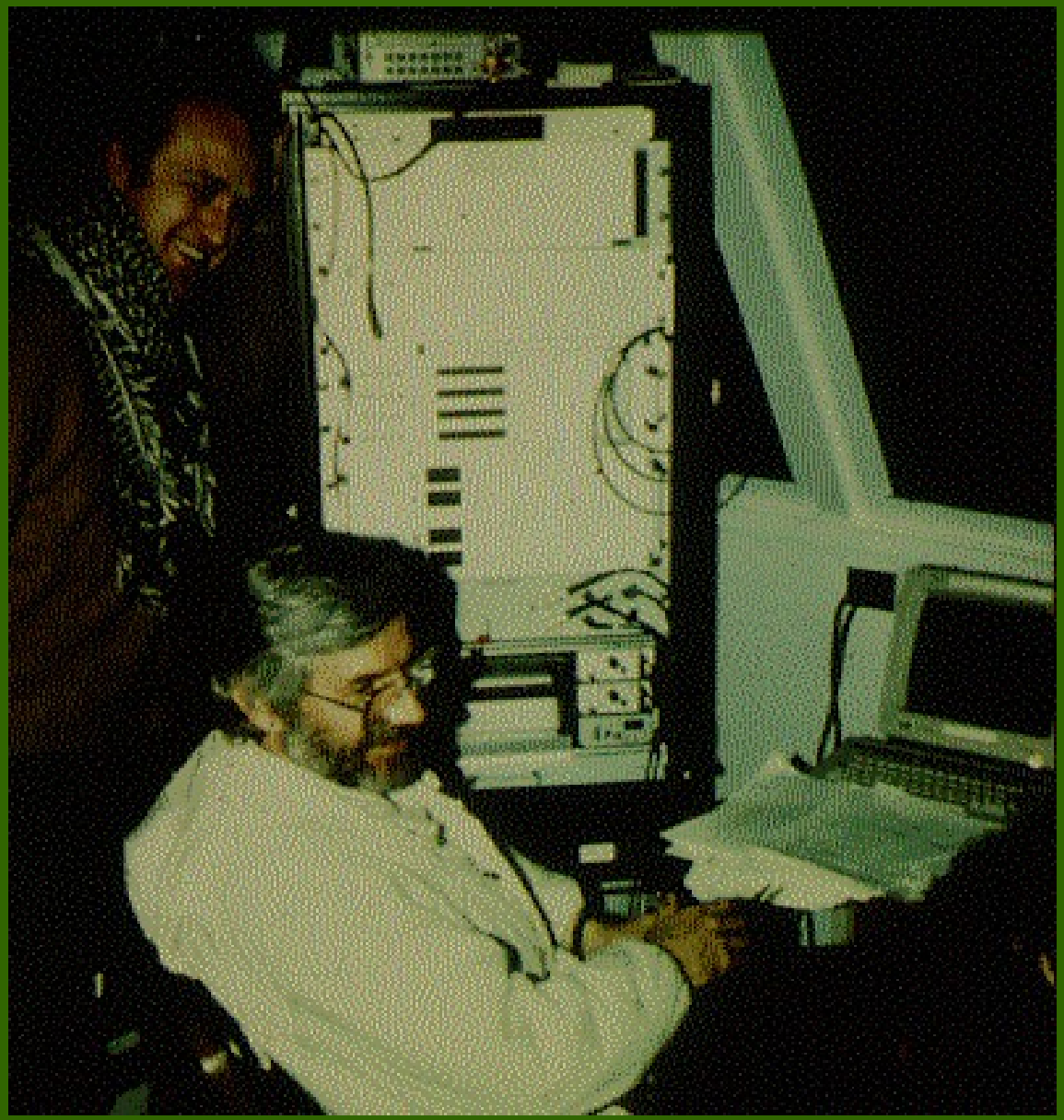
Sunny La Palma

not quite so sunny after all...

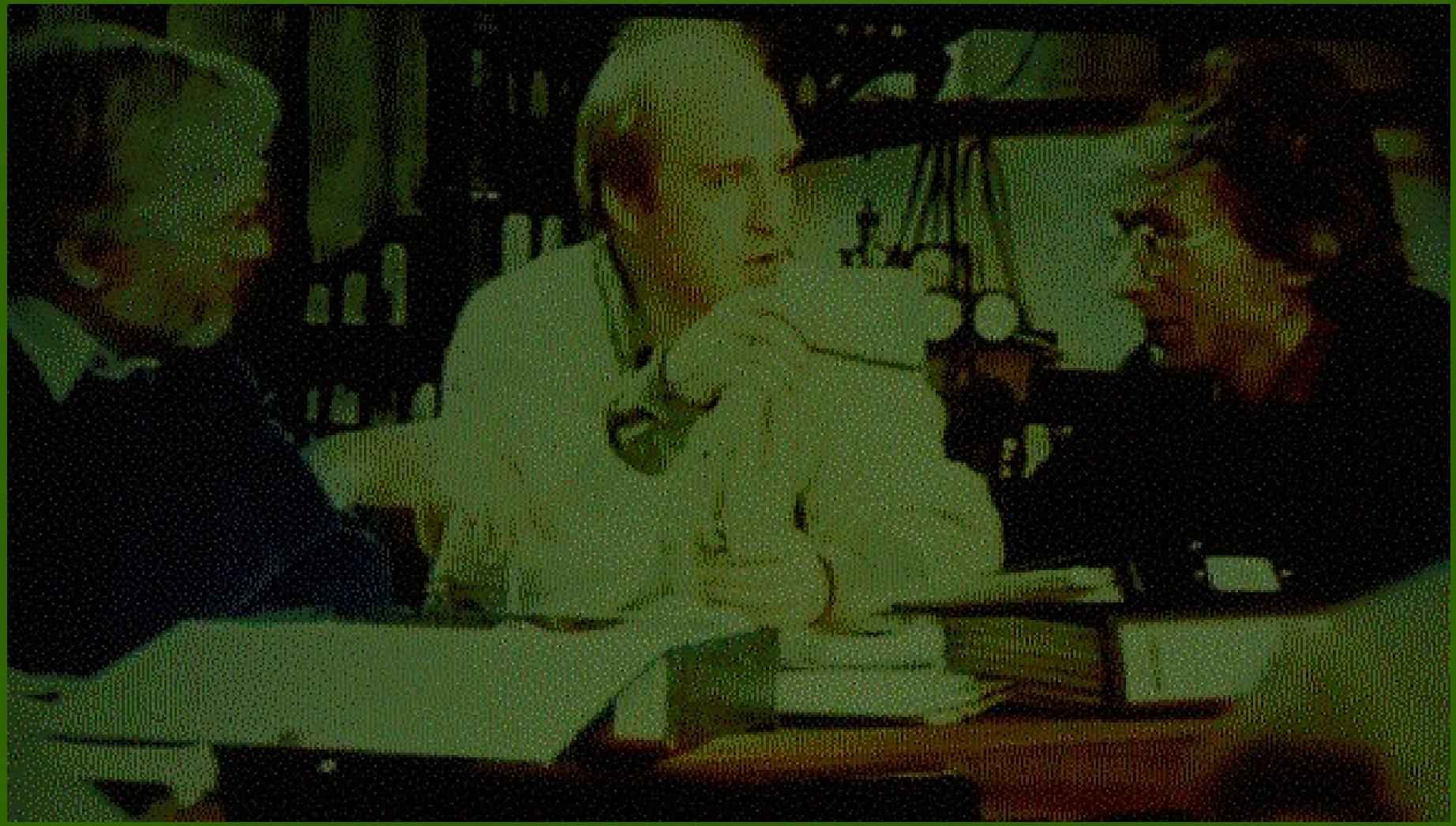
driving to work ...

a slight delay...

elegant surroundings



argue about the data...



thinking ....