

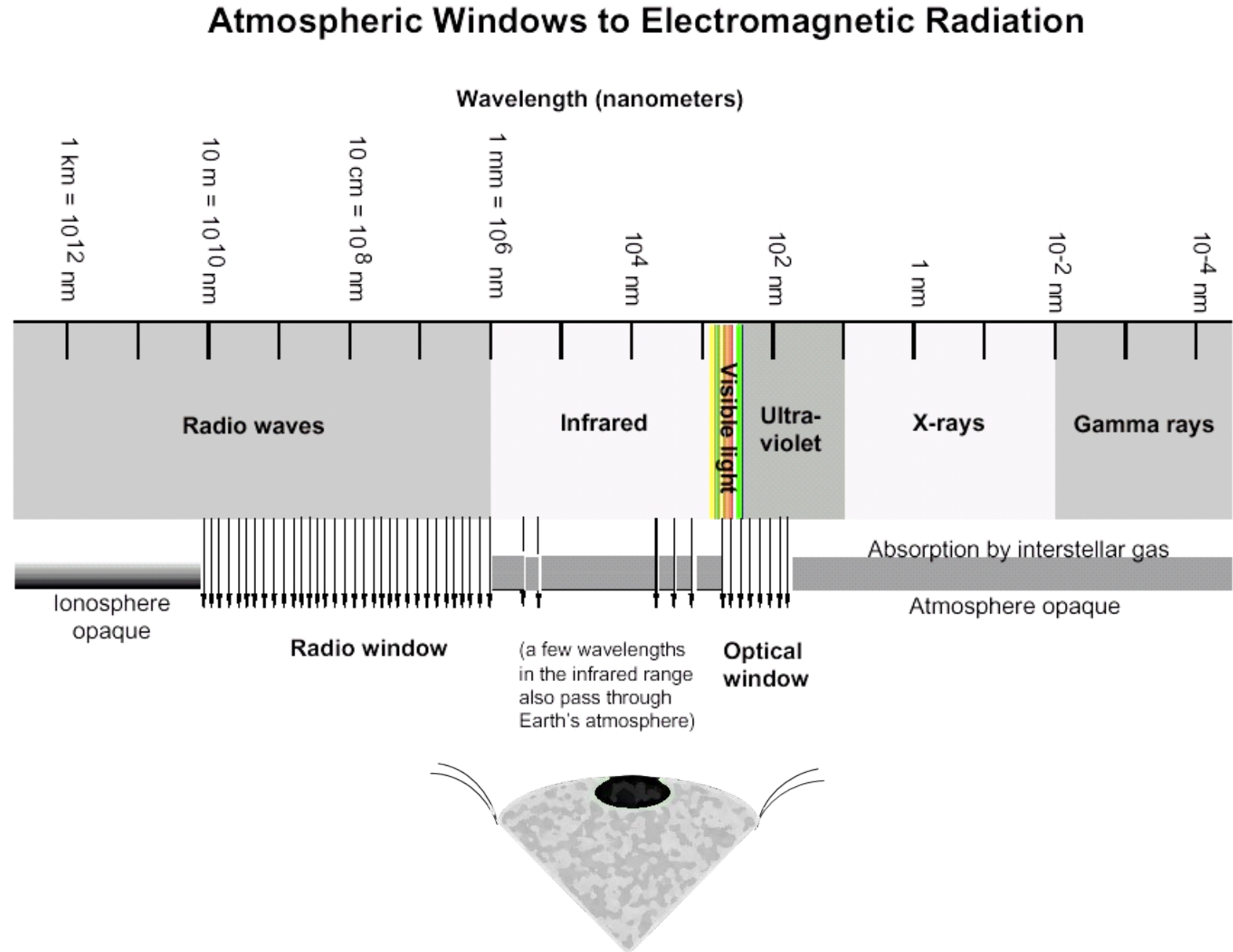
An introduction to
Space-based Telescopes

Zach Meisel

Ohio University - ASTR 1000

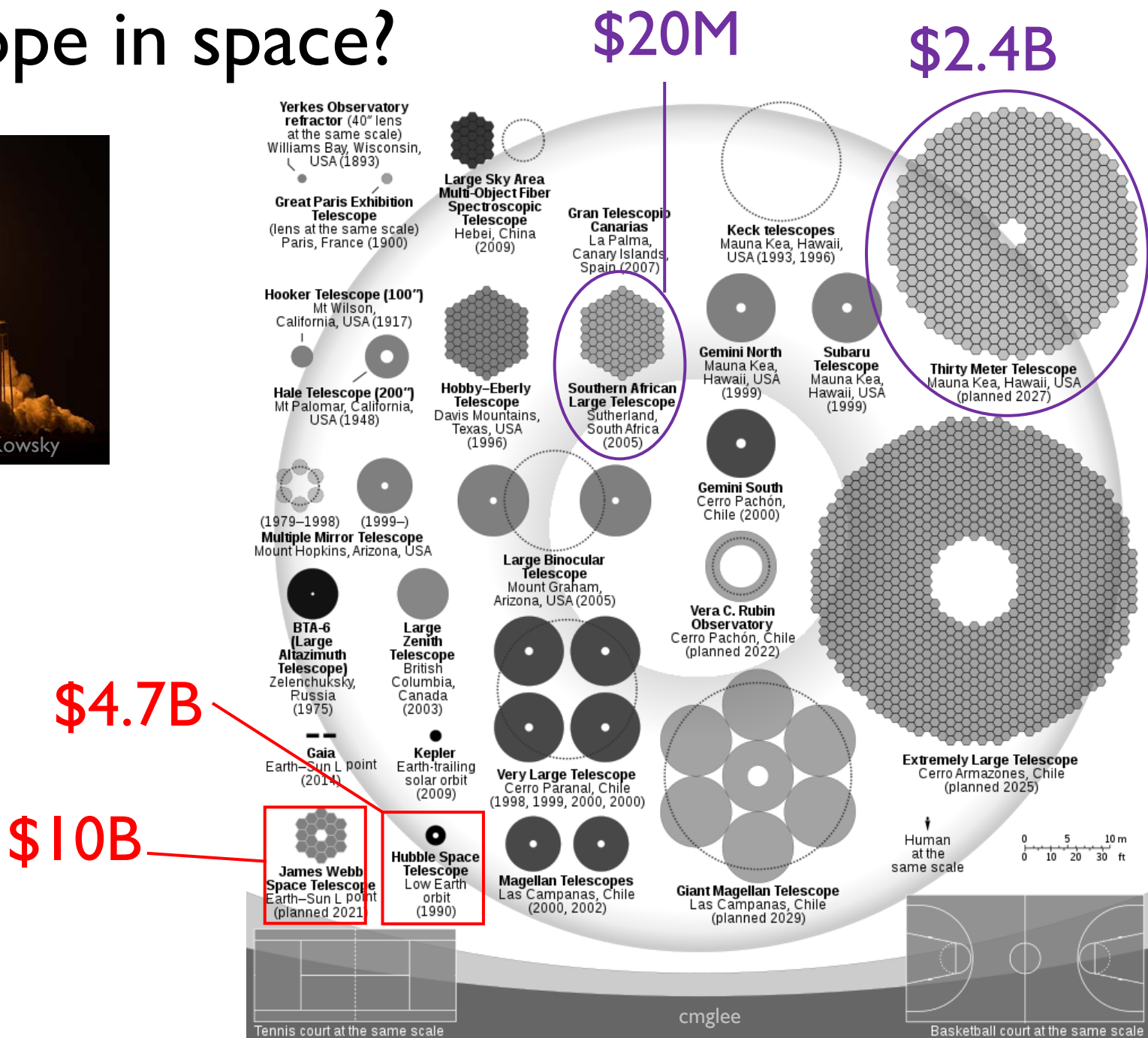
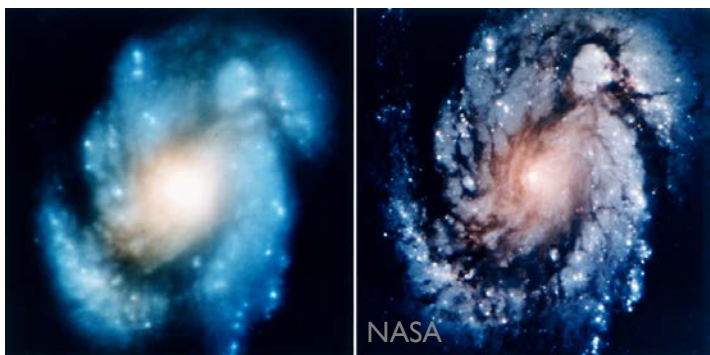
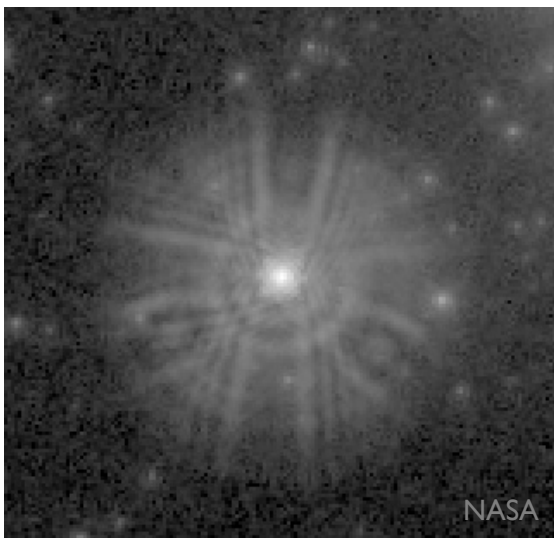
Why isn't every telescope on the ground?

- Only a portion of the electromagnetic spectrum can readily make it through the atmosphere without significant (or complete) absorption
...which is mostly a good thing!
- We must go into space for
 - X-ray and γ -ray telescopes
 - To see much of the wavelength region of interest for UV and infrared
 - To avoid atmospheric issues for optical telescopes



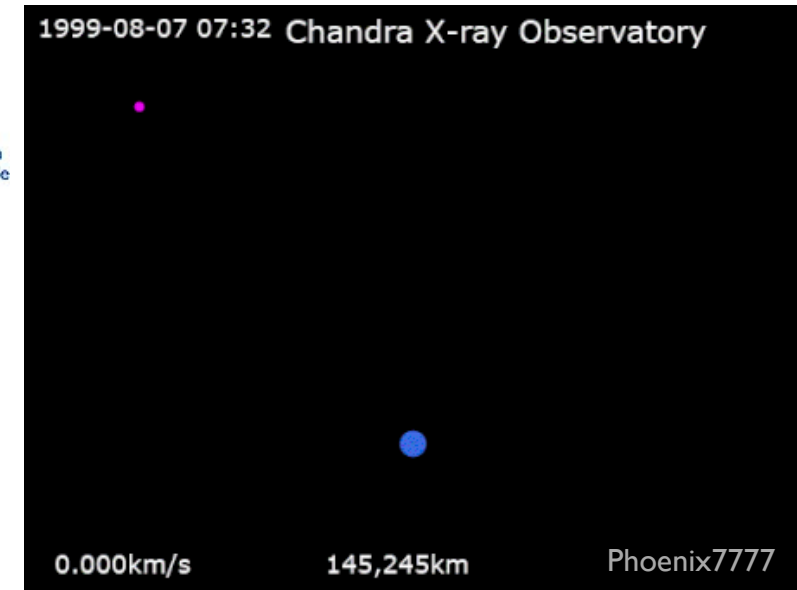
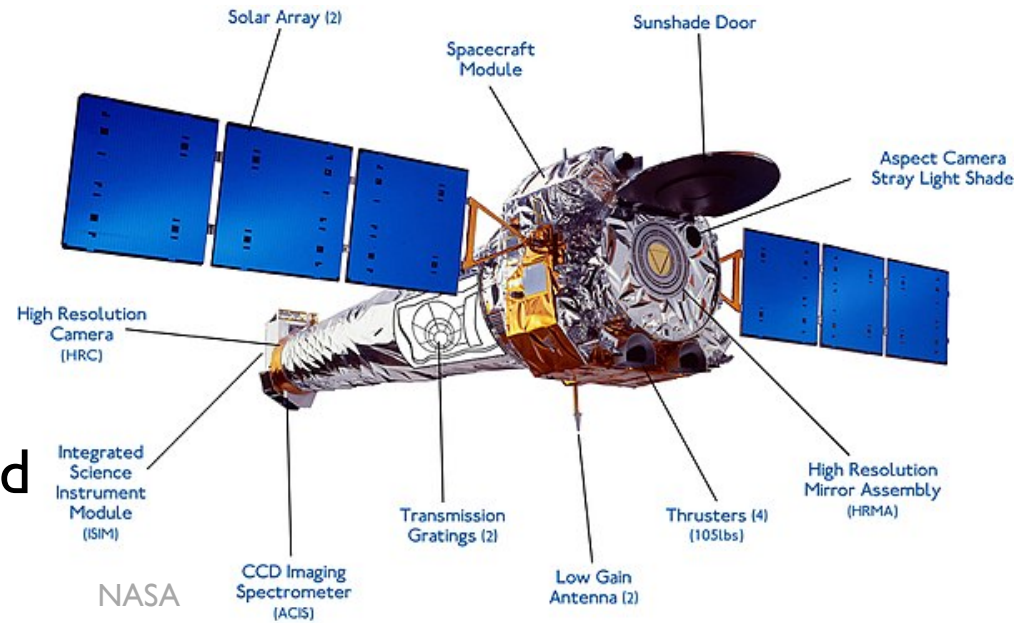
Why isn't every telescope in space?

- Money!
- Risk!
- Inconvenience!

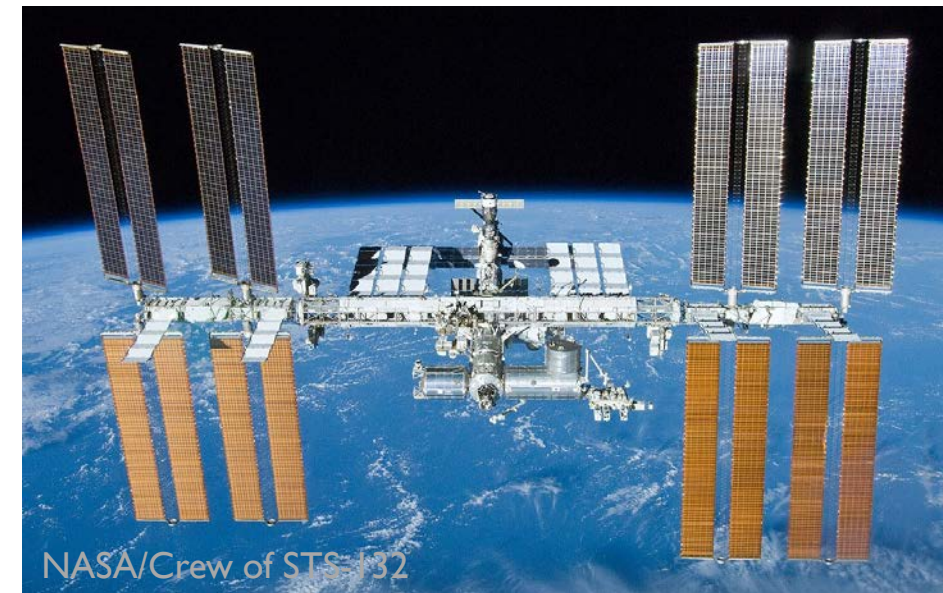
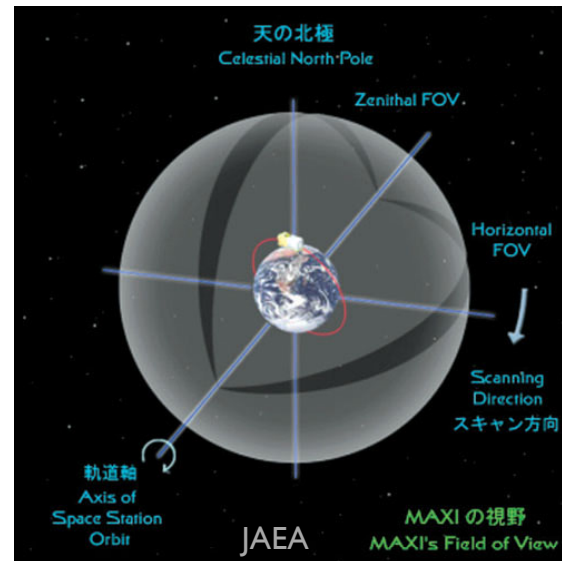


X-ray telescope examples: *Chandra* & *MAXI*

- Chandra is its own satellite, in a highly elliptical orbit so as to rise above Earth's radiation belts, where lots of charged particles from the sun are captured by Earth's magnetic field

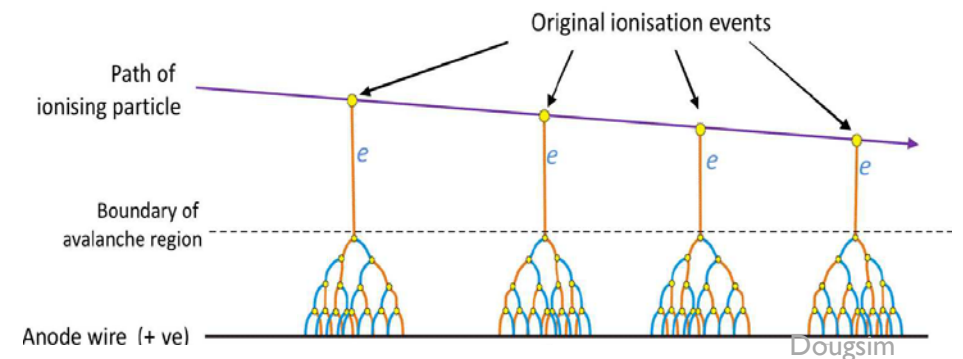
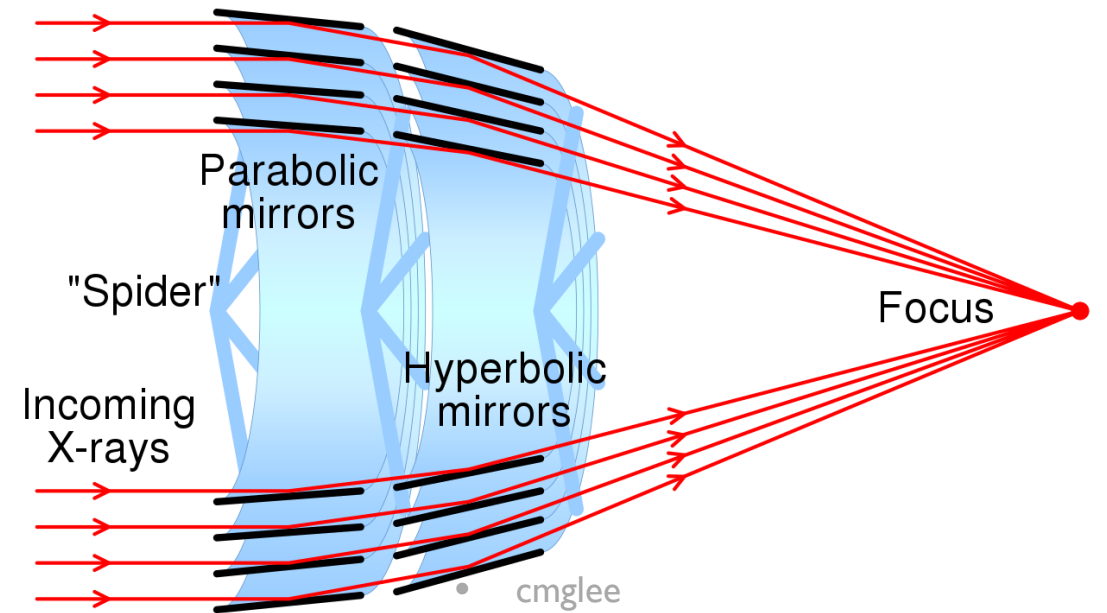


- MAXI is aboard the international space station, making it a serviceable instrument that regularly scans the whole sky



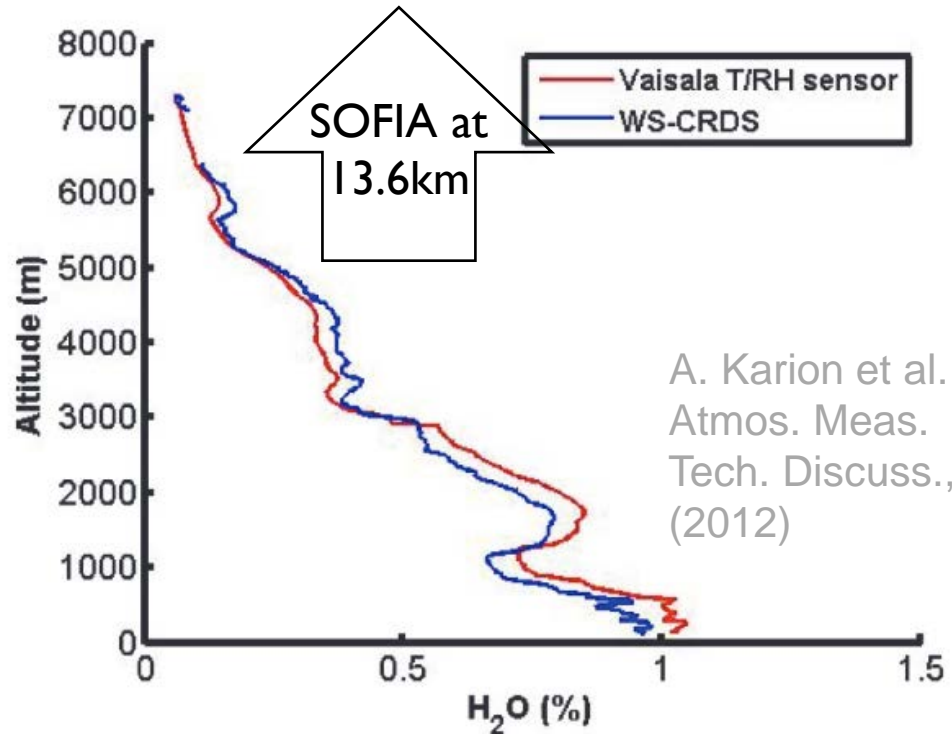
X-ray & γ -ray telescopes

- High-energy photons primarily scatter close to the same direction they come in at, so the mirror scheme for an optical telescope doesn't work
- Instead, “grazing mirrors” are used made of heavy metals
- The detector is often a CCD
(see ground-based telescope lecture)
for imaging or a proportional counter
or scintillator for counting
 - In a proportional counter, photons ionize atoms in a gas and electrons are collected
 - In a scintillator, photons excite atoms and molecules and the de-excitation emits lower energy photons, which are converted to electrons via the photoelectric effect (see ground-based telescope lecture)



Sometimes airborne is good enough

Balloon-based and airplane-based telescopes remove many observational issues associated with the atmosphere, while offering a lower cost and more convenience than a space-based device ...*while introducing new challenges!*



Stratospheric Observatory for Infrared Astronomy (SOFIA)



NASA / Jim Ross

