Optics and Telescopes II

- Things that can go “wrong”!
- Compound telescopes
  - Issues
  - Designs
- In-class exercise.

Magnification

“Perfect” image of point source

- Image aberrations.
- Size/engineering/total cost.
- Want fancy (generally big, heavy) detectors.

Perfect optics, no aberrations.

Actual Star

Airy Disc
Chromatic Abberation (CA)

*THIS ONLY HAPPENS IN LENSES!

Spherical Aberration

*THIS HAPPENS IN SPHERICAL LENSES AND REFLECTORS!

“Coma”

*THIS HAPPENS IN PARABOLIC LENSES AND REFLECTORS!

Other interferers

Diffraction spikes from secondary mirror support structures
Reflector Surface Accuracy

- General rule of thumb:
  \[ \sigma_{\text{surface}} \lesssim 0.1 \lambda \]

JWST secondary mirror (\( \lambda \approx 300 \text{ nm} \))

GMRT, India (\( f < 1 \text{ GHz}, \lambda > 30 \text{ cm} \))

Things that can go wrong...

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- Size/engineering/total cost.
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The problem with lenses...

Reflecting Telescopes

- Reflecting telescopes use mirrors.
- There are primary and secondary mirrors.
- Longer focal length can be achieved in smaller space – smaller telescopes