2 Estimate the angular resolution for a diffraction-limited telescope with a collecting aperture of 10 m diameter operating at a wavelength of 2 μm in the near infrared. What is the corresponding linear dimension in miles at the distance of Alpha Centauri (4.2 lightyears)? Suppose your telescope formed an interferometer with a baseline of 100 m, what would the resolution be now? Compare these numbers to distances within the solar system. Are you impressed? [Assume 1 lt-yr $\sim 6 \times 10^{12}$ miles.]

$$\theta \sim \frac{\lambda}{D} = \frac{2 \times 10^{-6}\ \mathrm{m}}{10\ \mathrm{m}} = 2 \times 10^{-7}\ \mathrm{rad} = 0.041\ \mathrm{as}$$

linear dimension at the distance of Alpha Centauri $\sim 2.5 \times 10^{13}\ \mathrm{ml} \cdot 2 \times 10^{-7} = 5 \times 10^{6}\ \mathrm{ml}$

~ 1/7 of the distance of Sun-Mercury (36 million miles)
~ 1/100 of the distance of Sun-Jupiter (480 million miles)
~ about 20 times of the separation of Earth-Moon (238k ml)
~ about ten times of the radius of the Sun (432k ml)

$$\theta \sim \frac{\lambda}{D} = \frac{2 \times 10^{-6}\ \mathrm{m}}{100\ \mathrm{m}} = 2 \times 10^{-8}\ \mathrm{rad} = 0.0041\ \mathrm{as}$$

linear dimension at the distance of Alpha Centauri $\sim 2.5 \times 10^{13}\ \mathrm{ml} \cdot 2 \times 10^{-8} = 5 \times 10^{5}\ \mathrm{ml}$

~ 2 times of Earth-Moon, Jupiter-Io (262k ml)
~ Jupiter-Europa (417k ml)
~ radius of the Sun (432k ml)