Homework Set 34E

PH 113 – 10

Q1. You use a lens of diameter D and light of wavelength λ and frequency f to form an image of two closely spaced and distant objects. Which of the following will increase the resolving power? (A) Use a lens with a smaller diameter; (B) use light of higher frequency; (C) use light of longer wavelength. In each case, justify your answer.

P1. If you can read the bottom row of your doctor's eye chart, your eye has a resolving power of one arcminute, equal to 1/60 of a degree. If this resolving power is diffraction-limited, to what effective diameter of your eye's optical system does this correspond? Use Rayleigh's criterion and assume *λ* = 550 nm.

P2. Two satellites at an altitude of 1200 km are separated by 28 km. If they broadcast 3.6-cm microwaves, what minimum receiving-dish diameter is needed to resolve (by Rayleigh's criterion) the two transmissions?

P3. Monochromatic light with wavelength 620 nm passes through a circular aperture with diameter 7.40 *μ*m. The resulting diffraction pattern is observed on a screen that is 4.50 m from the aperture. What is the diameter of the Airy disk on the screen?