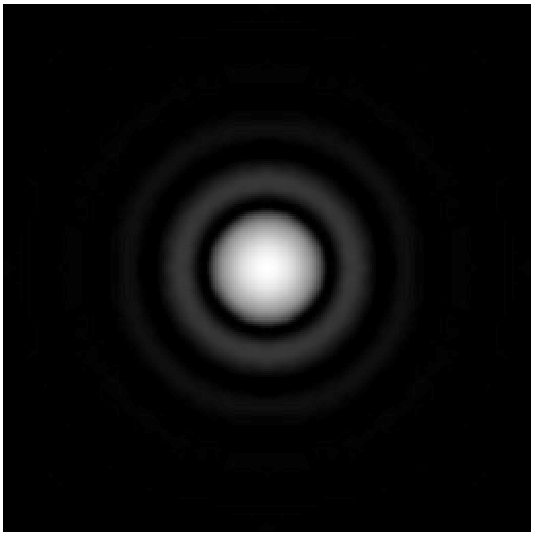


The bright spot is where most of the light energy falls, but it is surrounded by a large number of rings of light, called the diffraction pattern. The angle between the center of the main spot, and the first ring is given by the Airy Disk formula for θ.

Because like is a wave-like phenomenon, it causes interference when it is reflected and concentrated in an optical system. This pattern of interference makes it impossible to clearly see details that are smaller than this interference pattern.

There is a geometric relationship between the resolution of an imaging system and the wavelength at which it operates given by

$$\theta = 1.22\frac{\lambda}{D}$$

where θ is the resolution in units of radians, λ is the wavelength of the radiation in meters, and **D** is the diameter of the camera or telescope lens or mirror in meters.

Problem 1 - If 1 radian = 206265 arcseconds, what is the resolution formula in terms of arcseconds?

Problem 2 - A biologist wants to study deforestation with a satellite camera that has a pixel resolution of 10-meters/pixel, which at the orbit of the satellite corresponds to an angular resolution of 6 arcseconds. To measure the loss of plant matter, she detects the reflection by the ground of chlorophyll, which is the most intense at a wavelength of 700 nanometers (1 nanometer = 10^{-9} meters). What is the diameter of the camera lens that will insure this resolution at the orbit of the satellite?

Problem 3 – Construct a graph that shows the diameter of lens or mirror that is needed to obtain a resolution of 1 arcsecond from far-ultraviolet wavelengths of 200 nanometers to infrared wavelengths of 10 micrometers. From orbit, a human subtends an angle of 1 arcseconds, and emits infrared energy at a wavelength of 10 microns. How large would the camera have to be to resolve a human by his heat emission?

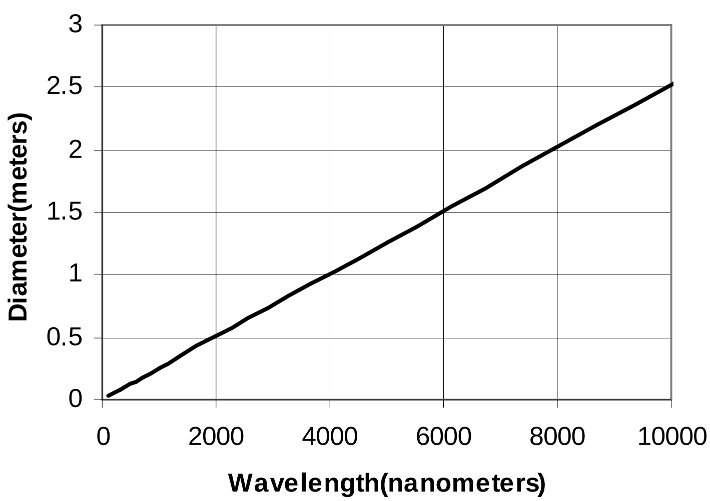
Problem 1 - If 1 radian = 206265 arcseconds, what is the resolution formula in terms of arcseconds?

Answer: θ = (1.22 x 206265) λ/D so θ = 251,643 λ/D

Problem 2 - A biologist wants to study deforestation with a satellite camera that has a pixel resolution of 10-meters/pixel, which at the orbit of the satellite corresponds to an angular resolution of 6 arcseconds. To measure the loss of plant matter, she detects the reflection by the ground of chlorophyll, which is the most intense at a wavelength of 700 nanometers (1 nanometer = 10^{-9} meters). What is the diameter of the camera lens that will insure this resolution at the orbit of the satellite?

Answer: We want q = 6 arcseconds. Then for l = 7.0×10^{-7} meters we have
D = 251,643 x 7.0×10^{-7}/6.0
D = 0.03 meters or 3 centimeters.

Problem 3 – Construct a graph that shows the diameter of lens or mirror that is needed to obtain a resolution of 1 arcsecond from far-ultraviolet wavelengths of 100 nanometers to infrared wavelengths of 10 micrometers (10000 nanometers). From orbit, a human subtends an angle of 1 arcseconds, and emits infrared energy at a wavelength of 10 microns. How large would the camera have to be to resolve a human by his heat emission?



Answer: **The graph suggests a mirror diameter of 2.5 meters!**