

- Two slits 0.5mm apart are placed 50cm from a screen. Calculate the distance between the 1st and 2nd dark lines of the interference pattern on the screen, if the slits are illuminated first with light of wavelength 500nm and then of wavelength 800nm.
[Ans. 0.5mm, 0.8mm]
- Light having a frequency 4×10^{14} Hz is incident on a grating formed with 10,000 lines per cm. What is the highest order spectrum that can be observed? [Ans. 1st]
- A diffraction grating with 200 lines per mm is 1cm wide. Show that the sodium doublet ($\lambda_1=589\text{nm}$ $\lambda_2=589.6\text{nm}$) can be resolved by the grating working in 1st order.
- A thin-film of thickness 2mm and $n=1.5$ is illuminated with light of (vacuum) wavelength 600nm. Calculate the order of interference m for the central fringe and determine whether it is a bright or dark fringe. [Ans. 10000, dark]
- A Fabry-Perot interferometer consists of two plane-parallel mirrors of 95% reflectivity spaced by 1cm of air. Calculate the free-spectral-range (assume normal incidence) and the finesse of the interferometer. [Ans. 15GHz, 61.2]
- By how much must one of the mirrors in a Michelson interferometer be moved if a detector records the traversal of 15,000 fringes? The source is a mercury discharge lamp with $\lambda=546.074\text{nm}$. [Ans 4.096mm]
- A sodium lamp emitting light in two narrow lines $\lambda_1=589.592\text{nm}$ and $\lambda_2=588.995\text{nm}$ illuminates a Michelson interferometer. By how much must the mirror be moved (from the position of zero path difference) in order to reach the first minimum of fringe visibility? [Ans. 0.145mm]
- A collimated beam of microwaves impinges on a metal screen that contains a horizontal slit 20cm wide. A detector moving parallel to the screen in the **far-field** locates the minimum of irradiance at an angle of 36.87° above the central axis. Estimate the wavelength of the radiation. How far must the detector be from the screen to be in the "far-field"? [Ans. 12cm, $\gg 40\text{cm}$]
- The United States Keck telescope is an optical astronomical telescope whose main mirror is 10m in diameter. Operating at 600nm, what is the approximate diffraction-limited angular resolution? Estimate at what range an observer using the Keck telescope could read the fine-print of a newspaper article. [Ans. 7.3×10^{-8} radians $\approx 0.015''$, approx 1.4km (!)]