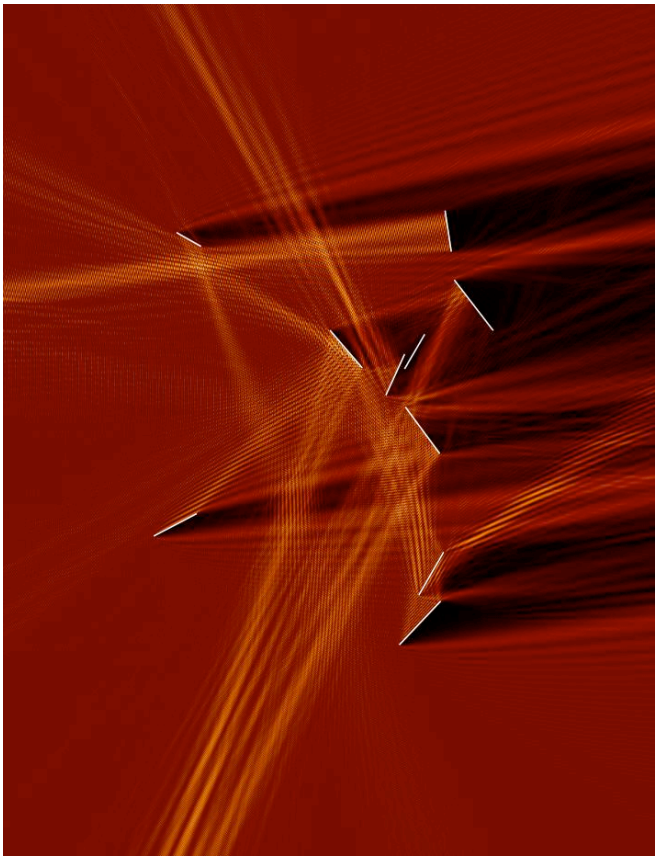
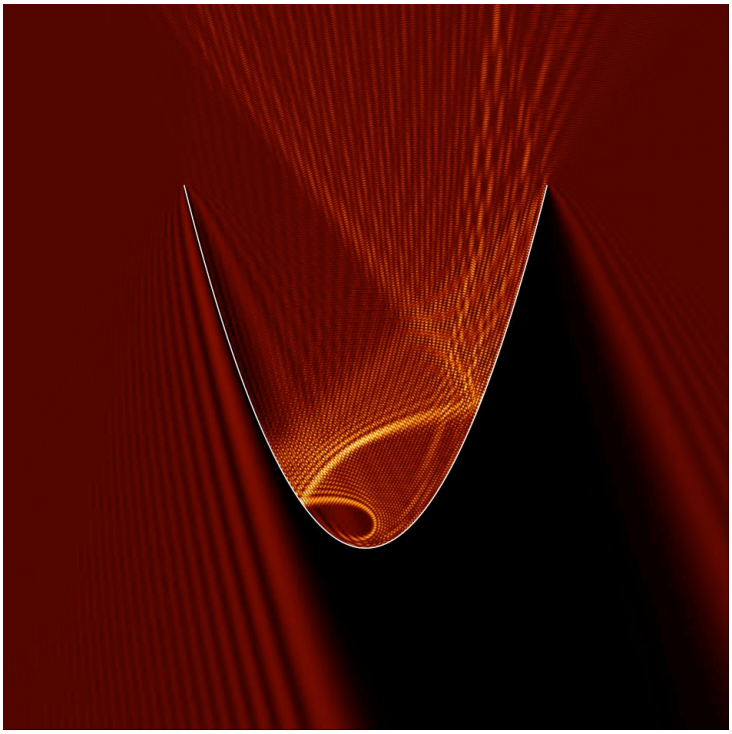
UCA Department of Physics and Astronomy

PHYS 3345: OPTICS





Assignment 02: Chapter 02
Spring 2008
DUE: January 25, 2008

Left: a plane-wave incident on a collection of small planes from the left.
Below: plane wave incident on a parabolic reflector.
Images courtesy of **Geomerics** (http://www.geomerics.com/technology.htm)

Work each problem neatly and completely. Unless otherwise noted, each problem is worth **5 points**. You should solve on green engineering paper or blank unruled paper. You must include sufficient demonstration of your problem solving process. If a problem is to be solved by inspection, state this. If graphs or plots are required, you should use an appropriate tool for their construction (there are several respectable options available on the computers in LSC 114).

1. Hecht, problem 2.33
2. Hecht, problem 2.35
3. Write the expression in Cartesian coordinates for a harmonic plane wave with amplitude A for which k = (2π/λ) and **k** is directed along a line from the origin through the point (4, 6, −2).
4. This is partial derivatives practice! Show explicitly that the Laplacian of $\psi(r)$ in spherical coordinates (see Hecht, page 29) can be written in any one of these forms (show that these are equivalent):

$$\nabla^2\psi(r) = \frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial\psi}{\partial r}\right)$$

$$\nabla^2\psi(r) = \frac{\partial^2\psi}{\partial r^2} + \frac{2}{r}\frac{\partial\psi}{\partial r}$$

$$\nabla^2\psi(r) = \left(\frac{1}{r}\right)\frac{\partial^2}{\partial r^2}(r\psi)$$

The *Schaum's Outline: Optics* supplement has many solved problems to assist you. In particular, you will find the following problems useful: 1.15, 1.52, 1.53, 1.63, 1.64