

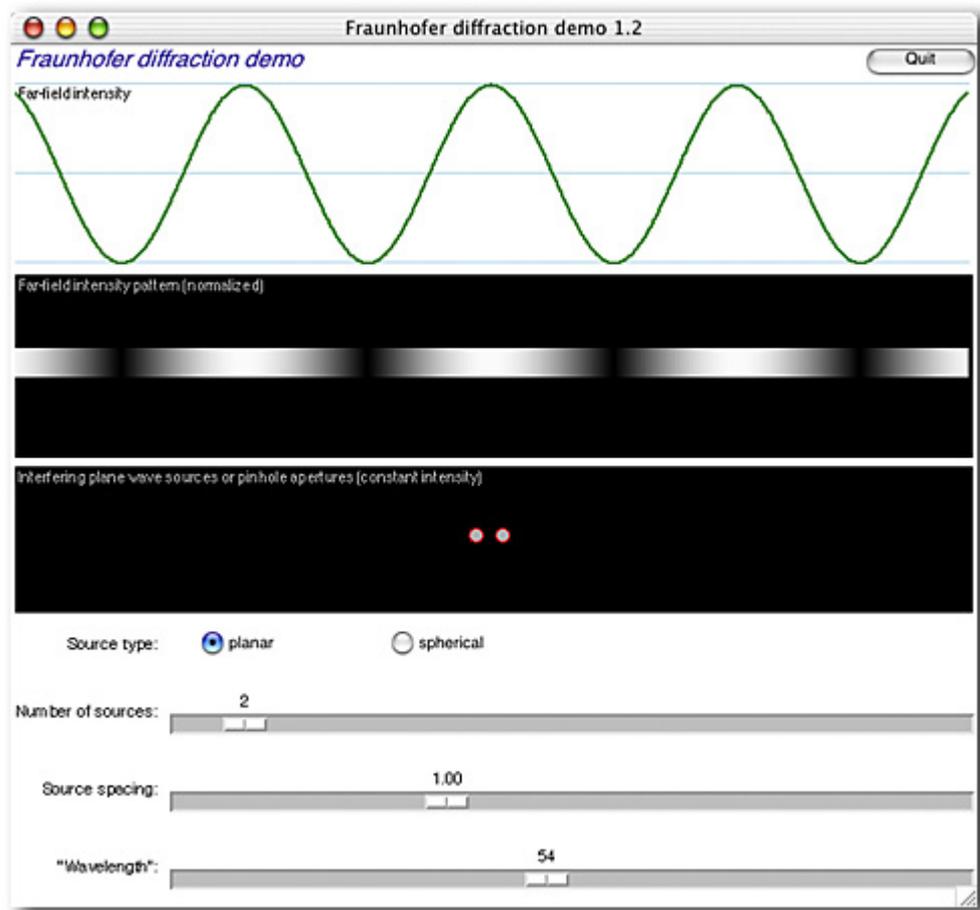
Fraunhoferdemo

Summary

Fraunhoferdemo simulates the diffraction pattern that results from the combination of a set of tandem, equally spaced point sources (or, alternatively, a collection of pinhole apertures). The points/pinholes can either be planar sources (in which case the diffraction pattern is the far-field pattern or Fourier transform of the points) or spherical sources placed at a fixed and moderate distance from the simulated projection screen. The demo program displays the set of points, the far-field or finite-field intensity pattern the points generate, and a graph of the intensity pattern. The number of sources, their type, their scale, and the wavelength of the light they emit can be control by sliders on the control panel.

Using the program

Fraunhoferdemo has the following appearance when it is started:



The demo window is broken up into several horizontal components:

Far-field intensity graph

The graph at the top of the user interface shows the intensity profile of the far-field pattern produced by the given set of coherent points or pinhole apertures. The height of the highest point on the graph

remains constant, but the scale of the graph changes as indicated by the blue horizontal lines that mark out units of intensity.

Far-field intensity pattern

The rendered intensity pattern simulates the appearance of the actual far-field intensity pattern that could be viewed projected onto a wall or card. The intensity of this pattern is normalized: the brightest part of the pattern is always of intensity 1. As more points are added, the pattern develops detail of finer and finer scale. Note that the displayed pattern is actually the square root of the far-field intensity pattern; this modification allows the smaller lobes of the pattern to be better observed on a typical computer monitor.

Source diagram

The source diagram shows the points or pinholes generating the pattern. As the controls of the demo are adjusted, the number of points, their spacing, and their intensity change. The intensity of the sources is fixed so that the total (incoherent) intensity of the sources is a constant value of 1: increasing the number of sources decreases the intensity of each source. (Again, the actual intensity of the displayed point in the user interface is the square root of the point's intensity to improve visibility.)



Controls

Source type

Two radio buttons control the shape of the wavefront of the sources. If planar sources are chosen, the

wavefront emitted by each source is a plane wave of appropriate inclination. The resulting pattern is a Fraunhofer or far-field pattern. If the sources are instead set to be spherical, the resulting pattern is more of a near-field pattern (although the projection screen is still a moderate distance from the points). The most significant change to notice when observing the pattern resulting from spherical sources is that the spacing of the bright spots or maxima increases towards the edges of the pattern.

Also note that in any case, the light emitted from the points in the simulation does not fall off with distance. In addition, the sources are omni-directional and non-localized: light from each source shines on all parts of the projection screen with equal brightness and no falloff of any kind.

Number of sources

This slider changes the number of sources that contribute to the interference/diffraction pattern. The sources maintain their spacing as new sources are added (*i.e.*, the scale of the pattern remains the same while the width of the pattern increases).

Source spacing

This slider narrows or widens the width of the source collection while keeping the sources equidistant from each other. Narrowing the spacing increases the scale of the far-field pattern (decreasing its frequency), while widening the spacing squishes the pattern (increasing its frequency).

"Wavelength"

Simulates changing the wavelength of the sources. Since the physical scale of the pattern is not specified, the wavelength doesn't correspond to any particular radiation (hence the quotes around wavelength). The scale of the far-field pattern is proportional to the wavelength of the sources.

