

Density and Phase Knife-Edge

We will look at the Fresnel diffraction pattern for both a density knife-edge and a phase knife-edge

- The *Mathematica* equations used in the calculations

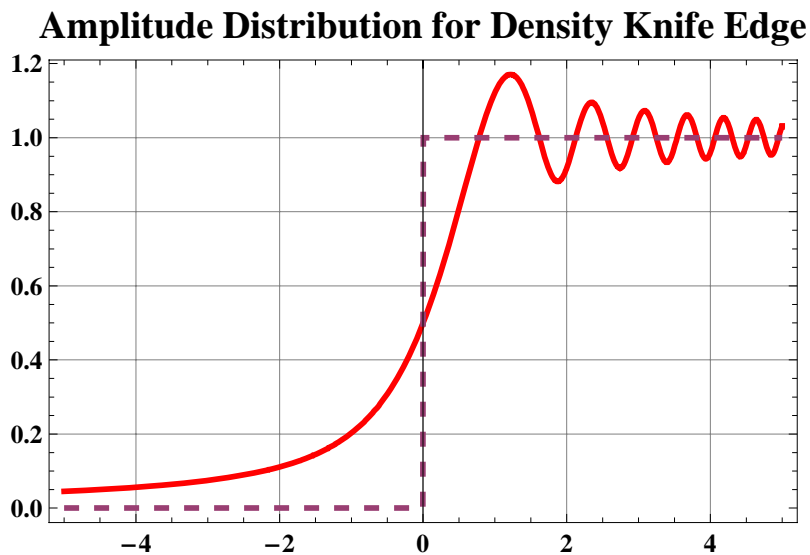
$$\text{amplitude}[u1_, u2_] := \frac{\text{FresnelC}[u2] - \text{FresnelC}[u1] + i (\text{FresnelS}[u2] - \text{FresnelS}[u1])}{\sqrt{2}}$$

$$\text{irradiance}[u1_, u2_] := \text{Abs}[\text{amplitude}[u1, u2]]^2$$

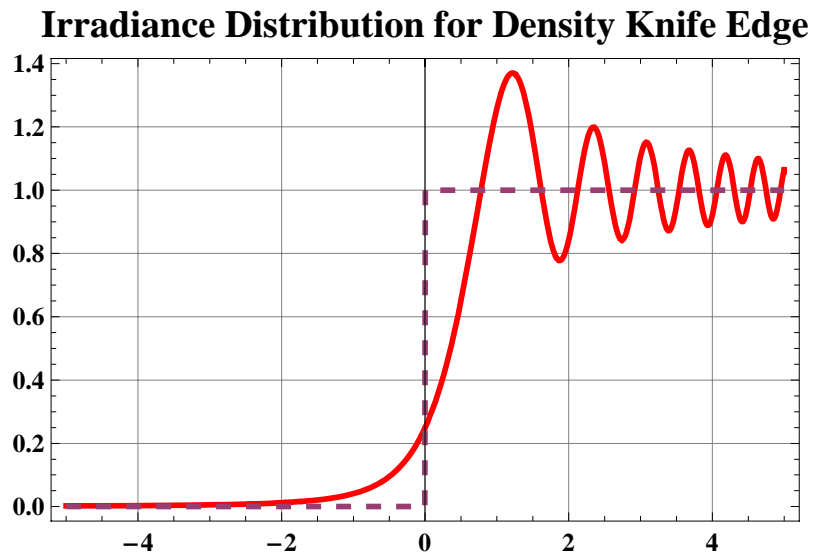
- Fresnel Diffraction pattern for density knife edge

The dashed line in the following plots shows the geometrical shadow.

```
Plot[{Abs[amplitude[η, -∞]], If[η < 0, 0, 1]},
{η, -5, 5}, PlotRange → All, PlotLabel →
Style["Amplitude Distribution for Density Knife Edge", 18, Bold],
Evaluate[plot2doptions4]]
```



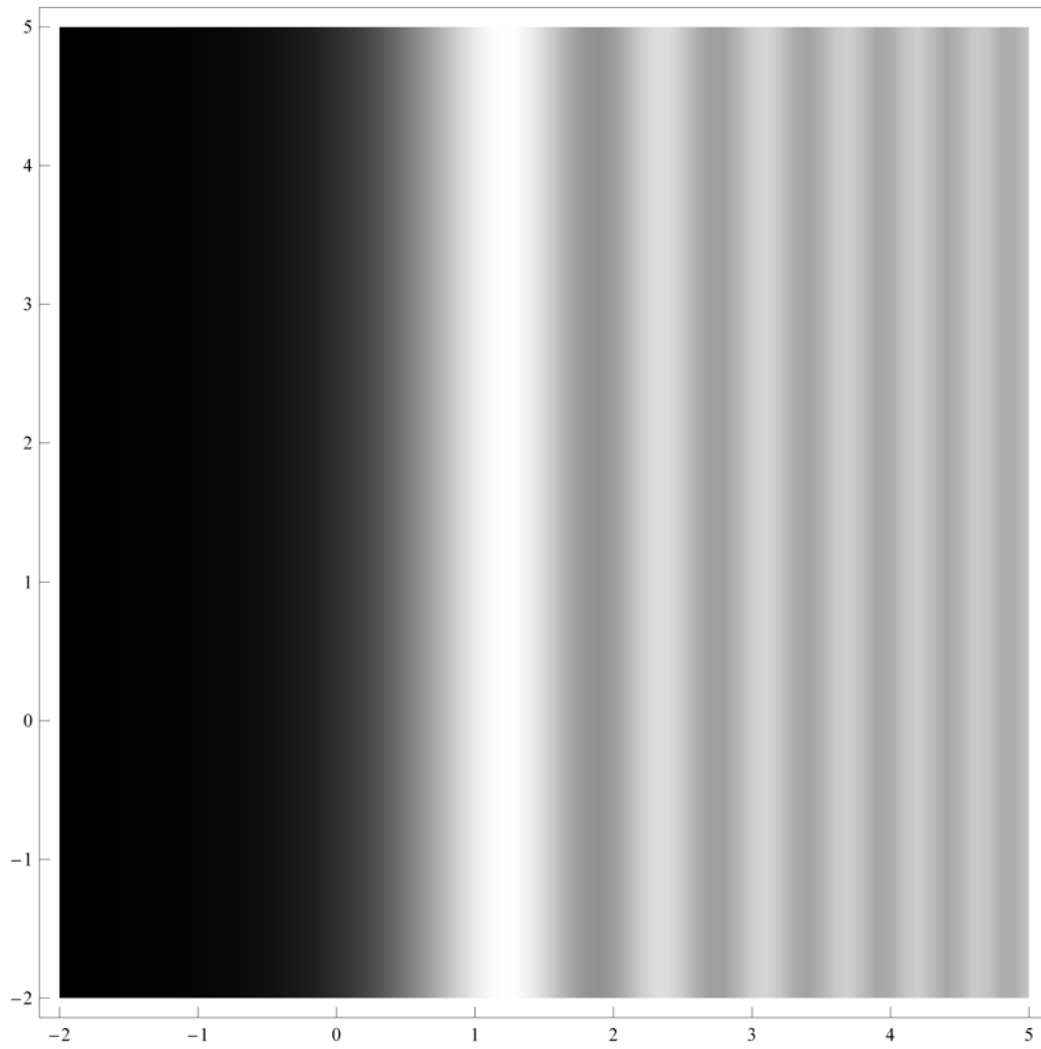
```
Plot[{irradiance[ $\eta$ ,  $-\infty$ ], If[ $\eta < 0$ , 0, 1]},
{ $\eta$ , -5, 5}, PlotRange  $\rightarrow$  All, PlotLabel  $\rightarrow$ 
Style["Irradiance Distribution for Density Knife Edge",
18, Bold], Evaluate[plot2doptions4]]
```



```
lineIrradiance = Table[irradiance[ $\eta$ ,  $-\infty$ ], { $\eta$ , -2., 5., 0.1}];
irradianceArray = Table[lineIrradiance, {i, 1, Length[lineIrradiance]}];
```

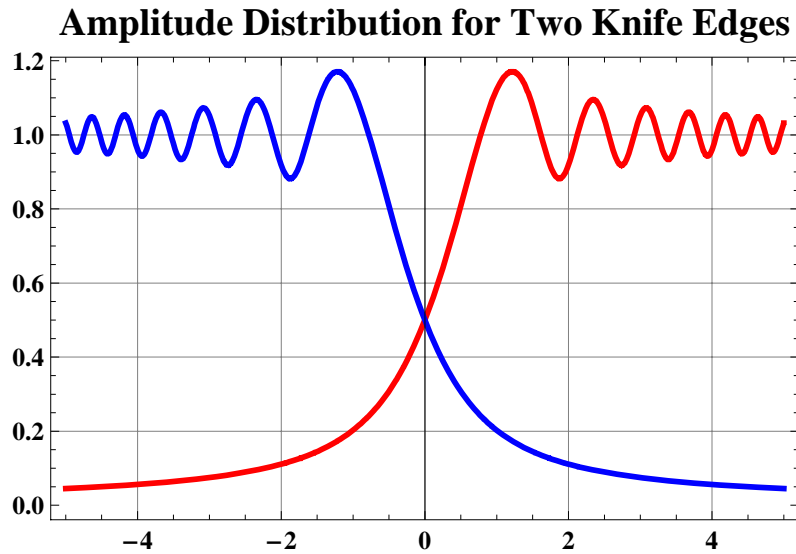
```
ListDensityPlot[irradianceArray, Evaluate[keDensityPlotOptions]]
```

Irradiance Distribution for Density Knife Edge

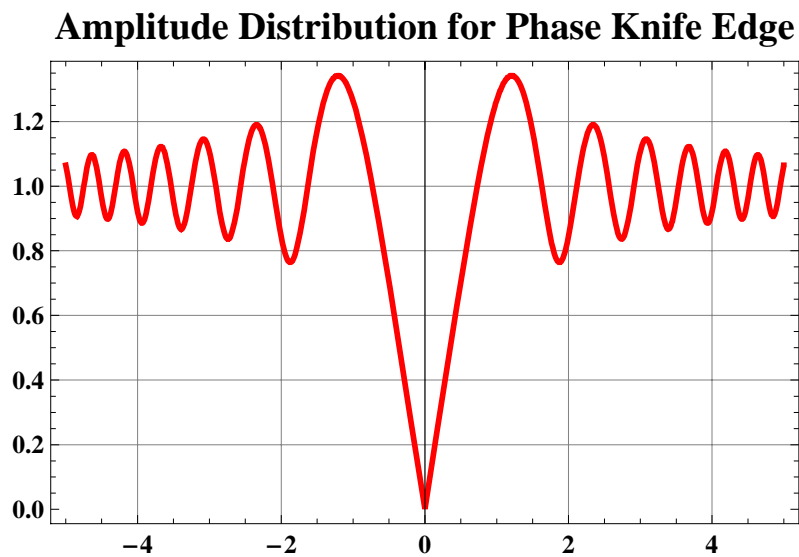


■ Fresnel Diffraction pattern for phase knife edge

```
Plot[{Abs[amplitude[-∞, η]], Abs[amplitude[η, ∞]]},
{η, -5, 5}, PlotRange → All, PlotLabel →
Style["Amplitude Distribution for Two Knife Edges", 18, Bold],
Evaluate[plot2doptions5]]
```

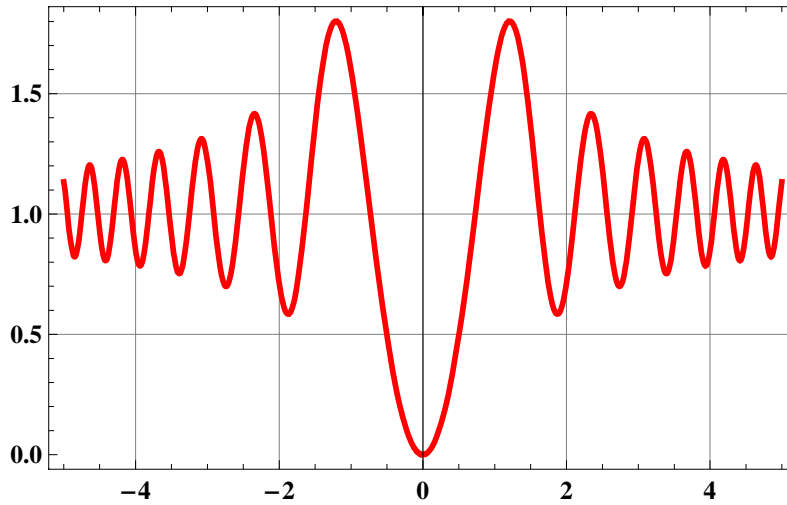


```
Plot[{Abs[amplitude[-∞, η] - amplitude[η, ∞]]},
{η, -5, 5}, PlotRange → All, PlotLabel →
Style["Amplitude Distribution for Phase Knife Edge", 18, Bold],
Evaluate[plot2doptions4]]
```



```
Plot[{Abs[amplitude[-∞, η] - amplitude[η, ∞]]2},
{η, -5, 5}, PlotRange → All, PlotLabel →
Style["Intensity Distribution for Phase Knife Edge", 18, Bold],
Evaluate[plot2doptions4]]
```

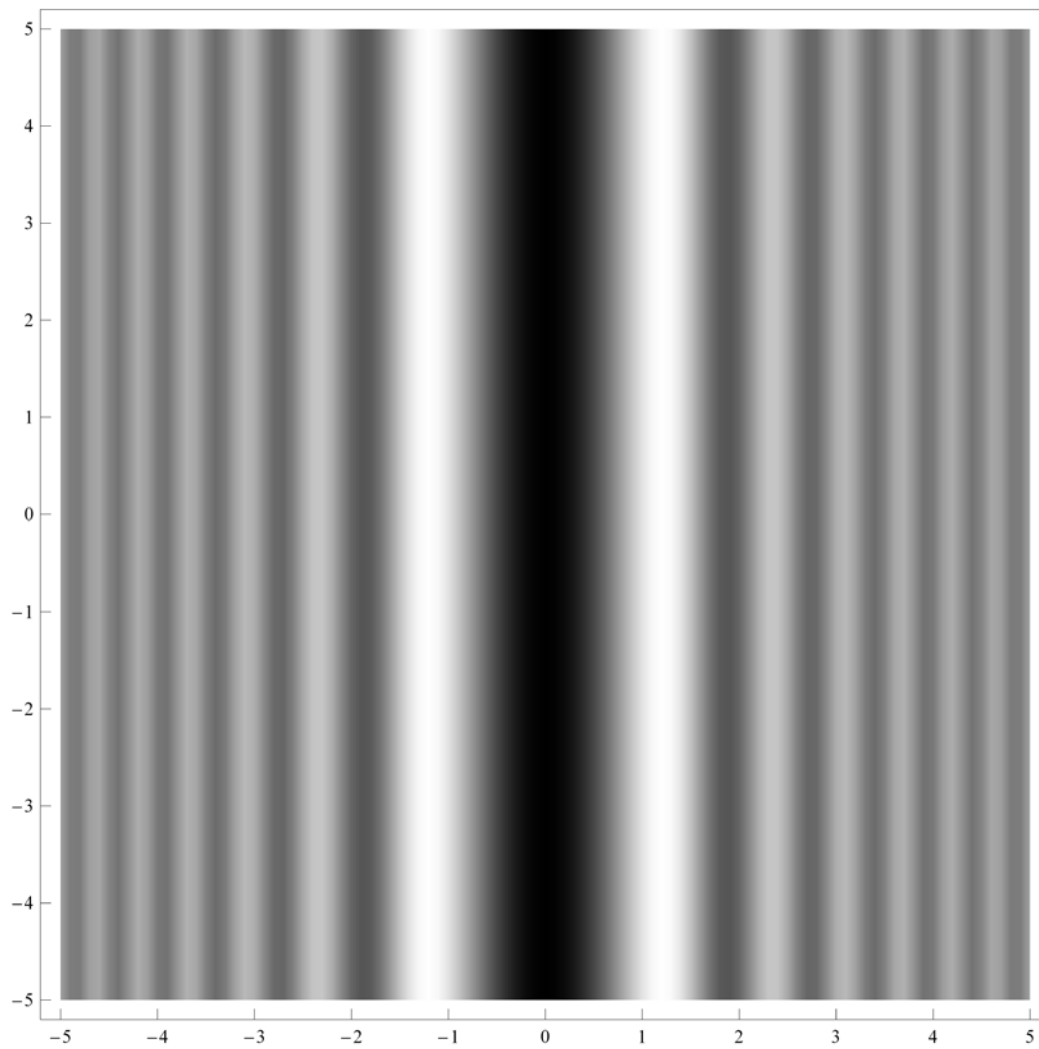
Intensity Distribution for Phase Knife Edge



```
lineIrradiance = Table[Abs[amplitude[-∞, η] - amplitude[η, ∞]]2, {η, -5., 5., 0.1}];
irradianceArray = Table[lineIrradiance, {i, 1, Length[lineIrradiance]}];
```

```
ListDensityPlot[irradianceArray, Evaluate[keDensityPlotOptions1]]
```

Irradiance Distribution for Phase Knife Edge



Plot Options