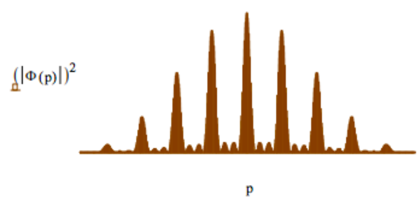
5.21: Multiple Slit Diffraction and the Fourier Transform

The American Journal of Physics published a translation of Claus Jonsson's paper "Electron Diffraction at Multiple Slits" in *American Journal of Physics* **42**, 4-11 (1974). The following calculation is in agreement with the diffraction pattern reported by Jonsson.

A four slit geometry is created. This represents the coordinate space wave function. It is Fourier transformed into the momentum representation to generate its diffraction pattern.

$$\text{Number of slits:} \quad n=4 \quad \text{Slit positions:} \quad j=1..n \quad x_j=j \quad \text{Slit width:} \quad \delta=.2$$

$$\Phi(p)=\frac{\sum_{j=1}^{n}\int_{x_j-\frac{\delta}{2}}^{x_j+\frac{\delta}{2}}\frac{1}{\sqrt{2\pi}}exp(-ipx)\frac{1}{\sqrt{\delta}}dx}{\sqrt{n}}$$



The momentum wave function is Fourier transformed back to coordinate space to generate the spatial wave function or slit geometry.

$$x=0,.01..5 \quad \Psi(x)=\frac{1}{\sqrt{2\pi}}\int_{-30}^{30}exp(ipx)\Phi(p)dp$$