Multiple Slit Diffraction and the Fourier Transform

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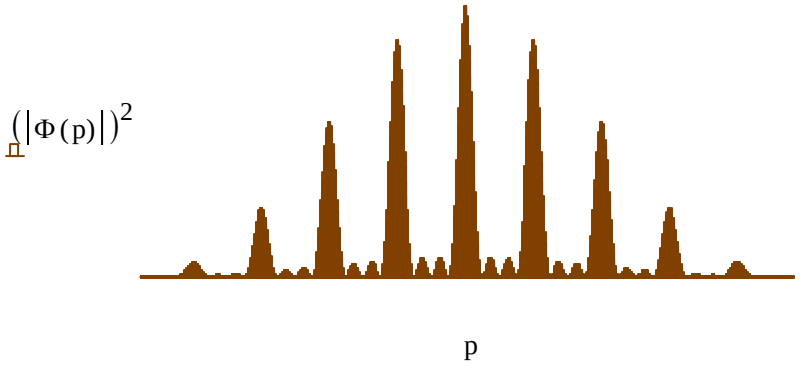
The *American Journal of Physics* published a translation of Claus Jonsson's paper "Electron Diffraction at Multiple Slits" in *American Journal of Physics* **42**, 4-11 (1974). The following calculation is in agreement with the diffraction pattern reported by Jonsson.

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.

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

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



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

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