

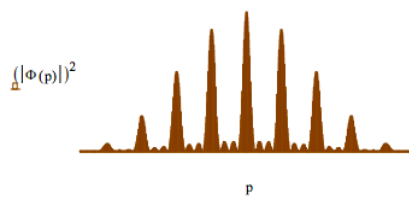
## 5.21: Multiple Slit Diffraction and the Fourier Transform

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.

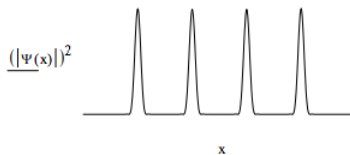
Number of slits:  $n = 4$  Slit positions:  $j = 1..n$   $x_j = j$  Slit width:  $\delta = .2$

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



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

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



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