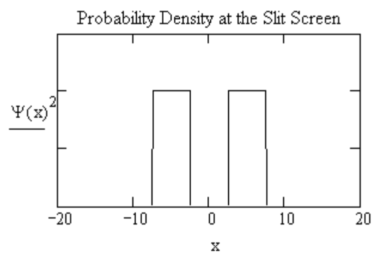
5.22: The Double-Slit Experiment with C60 Molecules

This is an attempt to capture with a simple model the behavior of C_{60} molecules in a double-slit experiment as reported in Nature Magazine (14 OCT 1999, pp 680-682). See *Eur. J. Phys.* **23**, 615-621 (2002) for the origin of the model.

The C_{60} wave function at the slit screen is shown below. This coordinate-space wave function is Fourier transformed into momentum space to obtain the momentum distribution at the slit screen. This momentum distribution is ultimately projected onto the detection screen.

In the work reported in Nature the slit width and the distance between slits was equal (50 nm). Arbitrary distance units are used here to illustrate the effect. The slit screen is actually a diffraction grating, but the researchers assumed the interference effect was caused by adjacent slits.

$$x = -20, -19.99, ..20 \qquad \Psi(x) = \text{if}\left[(x \geq -7.5)(x \leq -2.5) + (x \geq 2.5)(x \leq 7.5),\ \frac{1}{\sqrt{10}},\ 0\right]$$



$$P(p_x) = \left(\left|\frac{1}{\sqrt{2\pi}}\int_{-10}^{10} exp(-ip_x x)\Psi(x)dx\right|\right)^2 \qquad p_x = -3, -2.99, ..3$$