Stern-Gerlach 3

From the previous sections we have

$$\Psi = \begin{pmatrix} \psi_1 \\ \psi_2 \end{pmatrix}$$

where

$$\psi_1 = \operatorname{Ai}\left[\left(\frac{\alpha e}{2\hbar}\right)^{1/3} \frac{\alpha e \hbar}{8m^2}\, t^2 + \left(\frac{\alpha e}{2\hbar}\right)^{1/3} z\right] \exp\left(-\frac{ie\alpha zt}{4m}\right) \exp\left(-\frac{ieB_0 t}{2m}\right)$$

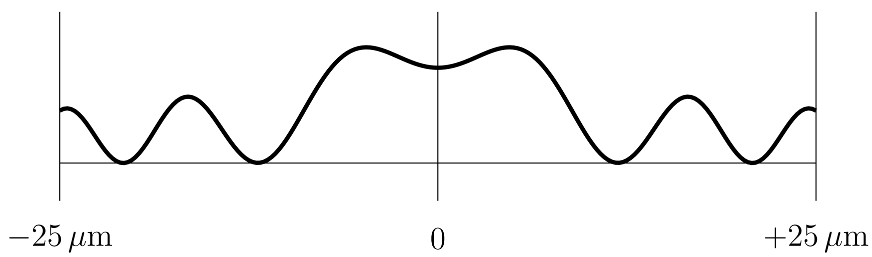
$$\psi_2 = \operatorname{Ai}\left[\left(\frac{\alpha e}{2\hbar}\right)^{1/3} \frac{\alpha e \hbar}{8m^2}\, t^2 - \left(\frac{\alpha e}{2\hbar}\right)^{1/3} z\right] \exp\left(+\frac{ie\alpha zt}{4m}\right) \exp\left(+\frac{ieB_0 t}{2m}\right)$$

The probability density for silver atoms is

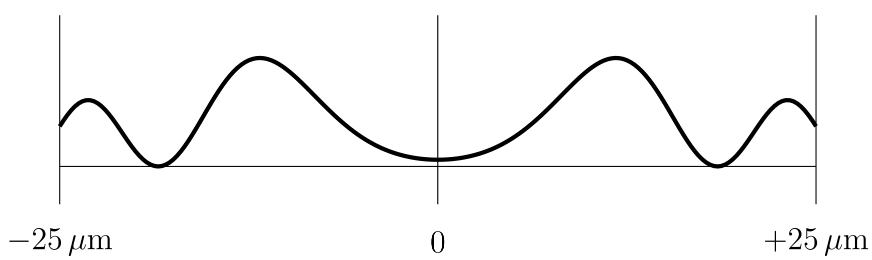
$$f(t,z) = \Psi^\dagger \Psi = |\psi_1|^2 + |\psi_2|^2$$

The following plots show the time evolution of silver atom density. Because we are using a polynomial approximation for the Airy function, it is necessary to use small values of deflection, i.e., $25\,\mu$m.

$t = 0$



$t = 0.1$



$t = 0.15$