

Quantum Mechanics: Homework on Wavepackets

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Using MATLAB plot the time and spatial variation of the probability density of electrons in GaAs with effective mass $m^*=0.065m_0$, where m_0 is the free electron mass, velocity $v=10^7$ cm/s. Assume that the standard deviation of the wavepacket is $\sigma=100$ nm. Plot it for times $t=0$, $t=0.1$ ps and $t=10$ ps. The probability density is given by the expression below.

$$P(x, t) = \psi^*(x, t)\psi(x, t) = \left(\frac{1}{2\pi}\right)^{1/2} \frac{1}{\sigma\sqrt{1 + (\hbar t / 2m\sigma^2)^2}} \exp\left[-\frac{(x - \hbar k_0 t / m)^2}{2\sigma^2 \left[1 + (\hbar t / 2m\sigma^2)^2\right]}\right]$$

Comment on the results obtained.