

Free Particle Time Dependence

Suppose that we have a wave packet, in x-space, of a free particle at $t=0$. How do we find what the wave function will be at time $t>0$? We know that the time dependent wave packet in its general form is:

$$\Psi(x,t) = \int_{-\infty}^{\infty} A(q) e^{iqx} e^{-i\hbar q^2 t / (2m)} \frac{dq}{2\pi}$$

So, if we can find the expansion coefficients (Morrison refers to this as the “amplitude function”), $A(q)$, at some time $t = t_0$, we can find the wave function at any later time by employing the above equation. Our first step is then to compute $A(q)$.