Lecture 3, Jan 14, 2022

Quantum Waves

- Classical travelling waves $\Psi = Ae^{i(kx-\omega t)}$) with amplitude A, wavelength $\lambda = \frac{2\pi}{k}$, $\omega = 2\pi\nu$; velocity of the wave is $c = \frac{\omega}{k}$
- Such a wave conveys no position information since it has constant amplitude and wavelength everywhere
- The Born interpretation: the square of the wavefunction at any point is proportional to the probability of finding the particle in space at that point (i.e. Ψ^2 is the probability density)
- This interpretation leads to some restrictions on Ψ:
  - It must be continuous
  - It must not be multi-valued
  - It must be normalizable (implies finite, can't be zero or constant)
- Time evolution of wavefunctions is governed by the Schrödinger equation: $\hat{E}\Psi = i\hbar\frac{\partial}{\partial t}\Psi$
- Wave packets are fuzzy in both temporal and spacial extent