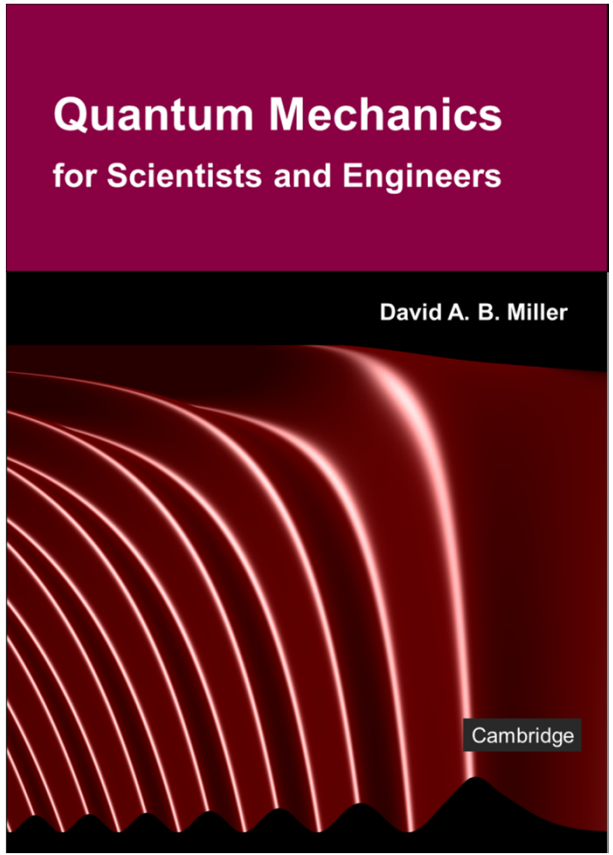
7.3 The hydrogen atom

Slides: Video 7.3.1 Multiple particle wavefunctions

Text reference: Quantum Mechanics for Scientists and Engineers

Chapter 10 introduction and Section 10.1



The hydrogen atom

Multiple particle wavefunctions

Quantum mechanics for scientists and engineers

David Miller

Multiple particle systems

How should we tackle this problem of two particles, electron and proton?

We start by generalizing the Schrödinger equation

writing generally for time-independent problems

$$\hat{H}\psi = E\psi$$

where now we mean that

the Hamiltonian $\hat{H}$ is the operator

representing the energy of the entire system

and ψ is the wavefunction representing the

state of the entire system

Multiple particle wavefunctions

For the hydrogen atom

there are two particles

the electron and the proton

Each of these has a set of coordinates associated with it

x_e, y_e, and z_e for the electron and

x_p, y_p, and z_p for the proton

The wavefunction will therefore in general be

a function of all six of these coordinates