Lecture 19

Two Dimensions

Again
The Pieces of the Course

• Wave particle duality
• Bound states of quantum mechanical potentials
• Quantum mechanical states of optical radiation field
• Interaction of quantized light and matter
Topics From Last Time

- Schrödinger’s equation in 2-D
- The scalar wave equation in 2-D
- Quantizing a rectangular drum membrane
- Gauss Hermite modes in a resonator with some square components
- Cylindrical coordinates
Topics For Today

• The scalar wave equation in 2-D
• Finite and infinite square wells
• Two dimensional SHOs
• Cylindrical coordinates
• Seq in cylindrical coordinates
• Finite and infinite cylinders
• SHOs in cylindrical coordinates
• Degeneracies
Finite and Infinite Rectangular Wells

• The frequencies of oscillation of a rectangular drum
• Limits on the energy levels of the nonleaking wave functions of a quantum well
• Solving recombination as unitary evolution
Two Dimensional SHOs

- SoV for an SHO C-rect coords
- Energy levels and propagation constants
- Degeneracies
- Gauss Hermite modes and why?
Seq in Cylindrical Coordinates

- TISE in Cylindrical Coordinates
- SoV into harmonics and radial
- Quantization of angular momentum
- When the boundary conditions work
- What the modes look like
- When chaos strikes
Homogeneous Cylinders

- Bessels’s equation
- Interior and exterior solutions
- Applying boundary conditions
- Real snare drum modes
- Step index fiber modes
Parabolic Index Fiber

• Radial equation
• Gauss Laguerre modes
• When GH and and when GL?
• Degeneracy
• Dispersion