

1. Spin

- Review of Angular momentum algebra
- Half-integer angular momentum
- Addition of angular momentum

2. Identical particles

- Schrödinger equation for N -particle systems
- Symmetry under two-particle exchange
- Slater determinant
- Pauli principle
- Fermi-Dirac and Bose-Einstein statistics

3. Time-independent perturbation theory

- Non-degenerate perturbation theory
- Degenerate perturbation theory

4. The real hydrogen atom

- Relativistic mass corrections
- Spin-orbit coupling
- Zeeman effect
- Hyperfine splitting

5. The helium atom, the hydrogen molecule, and the structure of larger atoms

- First order correction to He ground state due to e - e interactions
- The variational principle
- The hydrogen molecule ion
- The periodic table and the shell structure of atoms

6. Time dependent perturbation theory and the radiation of atoms

- Emission and absorption of radiation
- The golden rule
- Selection rules

7. The adiabatic approximation and geometric phases

- The adiabatic theorem
- Berry's phase
- The Aharonov-Bohm effect

8. Scattering theory

- Partial wave analysis
- Phase shifts
- The Born approximation

9. Topics relevant to quantum computation and quantum information

- The EPR paradox
- Bell's theorem
- The no-clone theorem
- Schrödinger's cat
- Zeno effect