

Lecture summary

- Group I (alkali) elements – Quantum defect theory
 - Asymptotic behavior of the Hydrogen radial wavefunction
 - Quantum defect
 - Core shielding : Modification to the Coulomb potential
 - Polarization of the ionic core by the valence electron
 - Core penetration
 - Connection to the classical picture and scattering theory
- Two-level system
 - Dynamics of a spin-1/2 system
 - Precession, Larmor frequency
- Rotating frame
- Rabi oscillation, Rabi frequency
 - Pi-pulse, $\pi/2$ -pulse, 2π -pulse
- Rabi's resonance method
- Bloch vector
- Off-resonance case, Rabi lineshape
 - Detuning

Homework

1. Textbook Exercise (4.3) Quantum defects of sodium
2. Textbook Exercise (7.2) Rabi oscillation.
3. Textbook Exercise (7.3) π - and $\pi/2$ - pulses.

Reading Assignments:

R.R. Freeman and D. Kleppner, "Core polarization and quantum defects in high-angular-momentum states of alkali atoms", Phys. Rev. A **14**, 1614 (1976)

Stories from the early days of quantum mechanics. By Isidor Isaac Rabi
Physics Today, pg 36, August 2006.