5

Kas teie arvates peaksin sellest õige teksti genereerima?

Kodutöö 5

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1 5. Stark effect. Derive a correction of energy and wavefunction.

The stark effecty is the splitting of spectral lines in external electric field. Firstly there is no splitting in the the first(n=1) level of the hydrogen atom but there is a split in the next (n=2) where it does so into three. We presume that our electrical field is in the direction of the z-axis(E= (0,0,E)). This situation gives us a perturbation for z-coordinate the only nonzero matrix elements are those, for which delta(m)= 0 and delta(l)=+ - 1 and in out case those are the z12 and z21=z12* elements. Hamiltonian as follows: H' =eEz where we take z as Bohr's radius (z=r0) The nonzero elements of the perturbation Hamiltonian are H'12=H'21=-3e*r0*E The corrections for E12 are two of eta = 0, meaning the energies of states psi3 = psi211 and psi4 = psi21-1 The remaining two are eta1,2 = + - sqrt((H'12)**2) = + - 3*e*r0*E. Those mean that the subspace of states psi1 = psi200 and psi2 = 210 energy levels split and the energies are (E1)**1 = -(R*h cvered)/4 +3*e*r0*E , (E2)**1 = -(R*h cvered)/4 -3*e*r0*E. The corresponding wave functions are: eta*c1 + 3*e*ro*E*c2=0 , eta*c2 + 3*e*ro*E*c1=0 , eta*c3 = 0 and eta*c4 = 0

2 9. Probability of interlevel transitions for first order of perturbation theory approximation. The case of harmonic external perturbation. The "golden rule" of quantum mechanics. Relationship between the "golden rule" and spectroscopy.

Harmonic perturbation is H'(t) = h*e**-(i*omega*t) + h**+ * e**(i*omega*t), h is an independent operator Next we find c1m which is c1m = -1/h covered * ((hmn * e**((omega mn - omega)*t)-1)/(omega mn - omega) + (hmn **(+) * e**((omega mn + omega)*t)-1)/(omega mn + omega)) absorbtion radiation

for us is omega mn ¿ 0. Omiiting in c1m the second summ an , we have c1m = -hmn/h covered *(e**(i(omega mn - omega)*t)-1)/(omega mn - omega)

From there we can get the corresponding tradition probability —c1m—**2 = (4*—hmn—**2)/(h covered)**2 * (sin**2(((omega mn - omega)*t)/2)))/(omega mn - omega)**2

The link to spectroscopy is that it measures transitions between quantum states.

3 17. How can we obtain a justification for the existence of spin in particles by using the Dirac equation?

The easiest justification is as follows: we use the rest system of a particle: p = 0 Our Hamilton operator is H= m0*c**2 *beta from there it is easy to verify that it commutes with the spin operator s = Big eta = h covered/2(sigma, zero; zero , sigma) These are spin 1/2 matrices correspondingly for upper and lowe components. since beta = (I, zero; zero , -I) is a diagonal, then it is obvious that —H, big eta—= 0 It means that Dirac equation has solutions with certain spin (1/2) and spin-projection. a calculation gives us big eta**2 = (3*(h covered)**2)/4 * I herefore all components correspond to spin 1/2.