

A photograph of a grand hallway with a frescoed ceiling and a red banner. The fresco depicts several figures in classical attire. The banner is red with white Chinese characters. The hallway has ornate architectural details and a decorative railing.

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Quantum Mechanics

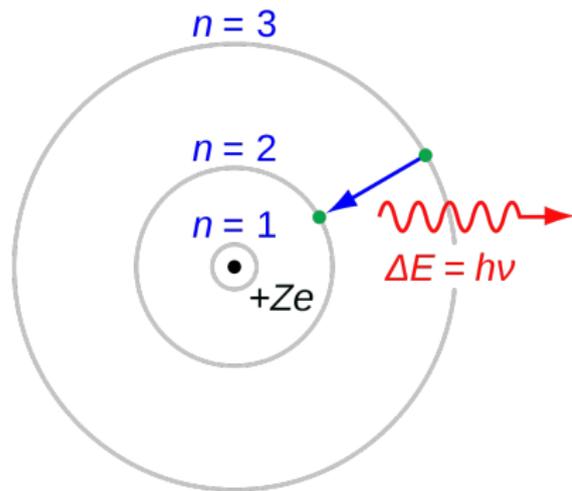
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Summer School on Particle Physics



Exercise I

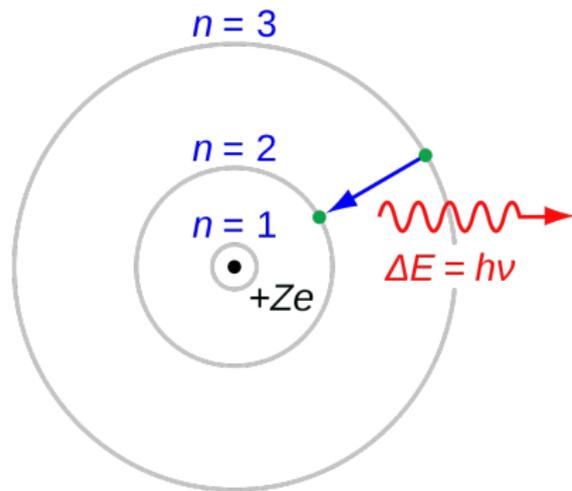
Balmer series spectral lines





Exercise I

Balmer series spectral lines



Remember that:

$$\lambda_{4 \rightarrow 2} = 486.1 \text{ nm}$$

$$\lambda_{3 \rightarrow 2} = 656.3 \text{ nm}$$

Useful formulae:

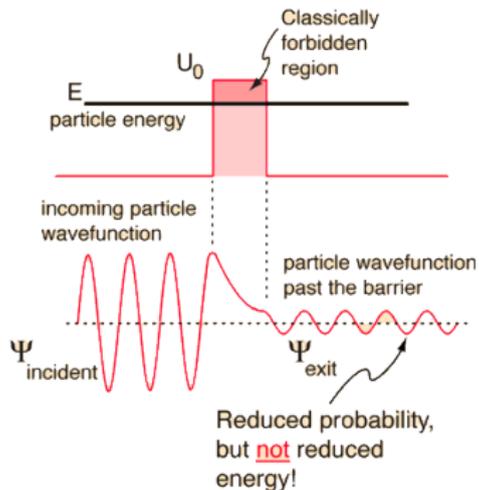
$$r_n \propto n^2 \quad U_{\text{Coul}} \propto -\frac{1}{r}$$

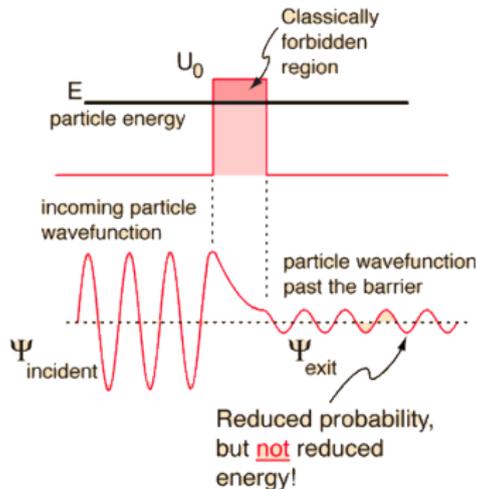
$$\Delta E_\gamma = h\nu \propto \frac{1}{\lambda}$$



Exercise II

Quantum tunneling





Exercise II

Quantum tunneling

Schroedinger + sanity:

$$\psi_{inc} = A \exp^{ik_1x} + B \exp^{-ik_1x}$$

$$\psi_{tun} = C \exp^{-k_2x}$$

$$\psi_{exit} = D \exp^{ik_1x}$$

Compute

- k_1, k_2 using the time independent Schroedinger equation
- A, B and D in terms of C, E, U_0 imposing continuity
- Check that there is a phase shift between ψ_{inc} and ψ_{exit}