

Atom och Molekylfysik - F01
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1 Hydrogenic Atoms

The Schrödinger equation for one-electron atoms, hydrogenic atoms. Ex: H , He^+ , Li^{++} , e^+e^- .

Components: Atomic Nuclei, mass M , charge Ze , electron mass m , charge, $-e$

Interactions $V(r) = \frac{Ze^2}{4\pi\epsilon_0 r}$, $r = |\vec{r}_1 - \vec{r}_2|$

Schrödinger eq for two particle system

$$-i\hbar \frac{\partial}{\partial t} \Psi(\vec{r}_1, \vec{r}_2, t) = \hat{H} \Psi(\vec{r}_1, \vec{r}_2, t) \quad (1)$$

Where \hat{H} is the Hamiltonian of the system representing the total energy of the system.

$$\hat{H} = \hat{T} + \hat{V} = \frac{\hbar^2}{2m_1} \nabla_{r_1}^2 + \frac{\hbar^2}{2m_1} \nabla_{r_2}^2 + V(r) \quad (2)$$

where

$$V(r) = -\frac{Ze^2}{4\pi\epsilon_0 r} \quad (3)$$