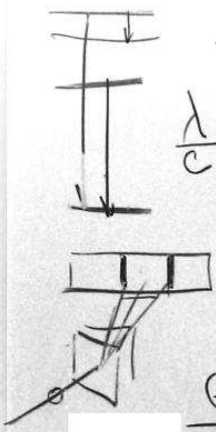

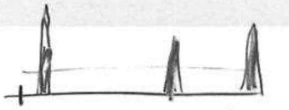

$\hbar = \frac{h}{2\pi}$ $E = h\nu = \hbar\omega$ $\bar{\lambda} = \frac{\lambda}{2\pi}$

energy

$\boxed{\nu \cdot 2\pi = \omega}$

$\frac{\lambda}{c} = \frac{1}{\nu}$

$\boxed{\frac{e^2}{2a_0}} = \frac{\hbar^2}{2ma_0^2}$

$\alpha = \frac{e^2}{\hbar c} \approx \frac{1}{137}$

$-\frac{\hbar^2}{2m}\nabla^2$

$\frac{e^2}{a_0}$

$\boxed{a_0 = \frac{\hbar^2}{me^2}}$

Gaussian units $\frac{e^2}{r}$

$\frac{\hbar^2}{ma_0^2}$ 13.6 eV

$\boxed{\text{a.u. energy}}$

SI $\frac{e^2}{4\pi\varepsilon_0 r}$

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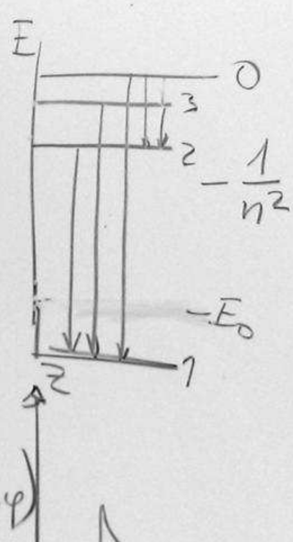
$\vec{x}_1$ $\vec{x}_2$, m_1 m_2

$\vec{R} = \frac{m_1\vec{x}_1 + m_2\vec{x}_2}{m_1+m_2}$ $\vec{r} = \vec{x}_1 - \vec{x}_2$

$M = m_1+m_2$ $\mu = \frac{m_1 m_2}{m_1+m_2}$



$m_1 = 1$ au

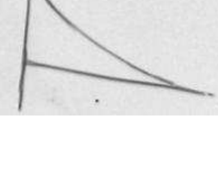
$m_2 = 1836$ au

n l m

$m_1 = \frac{1}{1836}$

$m_2 = 1.000\ldots$

$\psi_{nlm} = R_{nl}\, Y_{lm}(\vartheta,\varphi)$



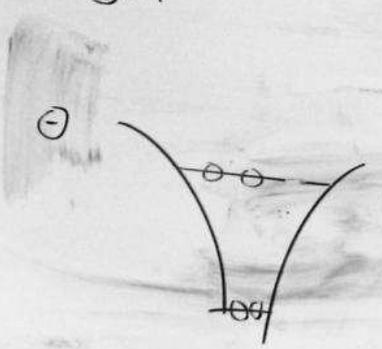
2005.09.07/p2.pdf

$\vec{x}_1 \quad \vec{x}_2, \quad m_1 \quad m_2$

$\ominus$ 1s $\qquad (1s)^2$

$\circledcirc$++

$\ominus$



$E_0 = \frac{1}{2}\frac{e^2}{a_0}$

H $\qquad -E_0$

$-\frac{E_0}{4}$

$-\frac{Z^2}{n^2}E_0$

-13.6 eV

-54.4 eV

spin

l integers

$k(k+1)$

$\hbar^2 l(l+1)$

L^2

$-l, -l+1 \ldots l-1 \ldots l$

$2l+1$

$l \longrightarrow s$

$(2s+1) = 2; \quad s = 1/2$

$\vec{\mu} \qquad \int \frac{j(\vec{r}')}{|\vec{r}-\vec{r}'|} dV$

$\frac{e}{mc} \qquad \boxed{g = 2}$

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spin $\Longleftrightarrow$ Dirac Equation

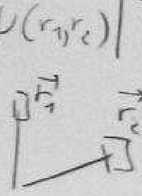
Relativistic generalization of Schrödinger Equation (with "extras")

H ... $\psi(\vec{r})$

He ... $\psi(\vec{r}_1, \vec{r}_2)$

?? $\psi_1(\vec{r}_1)\psi_2(\vec{r}_2)$

$|\psi(r_1, r_2)|^2 \;??\; |\psi_1(r_1)|^2 |\psi_2(r_2)|^2$



$P_1(1)\, P_2(2)$

$\boxed{\text{independent}}$

Pauli principle

at each level only one electron (with each spin)

$\boxed{\text{indistinguishable identical particles}}$

parahelium x orthohelium

$S=1 \qquad S=0$

$\uparrow\uparrow \qquad \leftarrow\rightarrow$

2005.09.07/p4.pdf