Lead Sheet: Hydrogen atom and Hydrogenic Systems

$$\hat{H} = \frac{-\hbar^2}{2m}\nabla^2 - \frac{e^2}{4\pi\varepsilon_0 r}$$

$$E_n^{(H\text{-atom})} = -\frac{me^4}{32\pi^2\varepsilon_0^2\hbar^2}\frac{1}{n^2}$$

$$= -\frac{13.6}{n^2}\ eV$$

$$= -\frac{0.5}{n^2}\ E_h$$

$$\psi_{100}^{(H\text{-atom})}(\vec{r}) = \left(\frac{1}{\pi a_0^3}\right)^{1/2} e^{-r/a_0}$$

a_0 = Bohr radius

$$= \frac{4\pi\varepsilon_0\hbar^2}{me^2}$$

$$\hat{H} = \frac{-\hbar^2}{2m}\nabla^2 - \frac{Ze^2}{4\pi\varepsilon_0 r}$$

(hydrogenic(類氫) system)

Hartree

$$E_n^{(\text{hydrogenic})} = -Z^2\frac{me^4}{32\pi^2\varepsilon_0^2\hbar^2}\frac{1}{n^2} = -Z^2\cdot\frac{1}{2n^2}(E_h)$$

$$\psi_{100}^{(\text{hydrogenic})} = \left(\frac{Z^3}{\pi a_0^3}\right)^{1/2} e^{-Zr/a_0} = \left(\frac{Z^3}{\pi a_0^3}\right)^{1/2} e^{-r/\left(\frac{a_0}{Z}\right)}$$