$$H_{approx.} = \sum_{i=1}^{N} h(i)$$

$$\Psi = \psi_a(1)\psi_b(2)\psi_c(3)\psi_d(4)......$$

$$\Psi = \frac{1}{\sqrt{N!}} Det\{\psi_a(1)\psi_b(2)\psi_c(3)\psi_d(4).....\psi_x(N)\}$$

$$H = \sum_{i=1}^{N} \left(\frac{\mathbf{p_i^2}}{2m} - \frac{Ze^2}{r} \right) + \sum_{i<j}^{N} \frac{e^2}{r_{ij}}.$$

$$\left(\frac{\mathbf{p_i^2}}{2m} - \frac{Ze^2}{r} \right) \psi_a(i)$$
$$+ \left[\sum_{b}^{occ} \int \psi_b(j) \; \frac{e^2}{r_{ij}} \; \psi_b(j) \; dV_j \right] \psi_a(i)$$

$$- \left[\sum_b^{occ} \int \psi_b(j) \ \frac{e^2}{r_{ij}} \ \psi_a(j) \ dV_j \right] \psi_b(i)$$

$$= \quad \varepsilon_a \psi_a(i).$$

$$h(i)\psi_a(i) = \varepsilon_a \psi_a(i).$$

$$h(i) = \frac{\mathbf{p_i^2}}{2m} - \frac{Ze^2}{r} + u_{HF}(i).$$

$$u_{HF}(i) \qquad \psi_a(i)$$

$$= \left[\sum_b^{occ} \int \psi_b(j) \frac{e^2}{r_{ij}} \psi_b(j) dV_j \right] \quad \psi_a(i)$$

$$- \left[\sum_b^{occ} \int \psi_b(j) \frac{e^2}{r_{ij}} \psi_a(j) dV_j \right] \quad \psi_b(i).$$

$$
\begin{aligned}
\left[\frac{\hbar^2}{2m}\left(-\frac{d^2}{dr_i^2}+\frac{\ell_a(\ell_a+1)}{r_i^2}\right)-\frac{Ze^2}{r_i}\right] &\quad P_a(r_i) \\
+\left[\sum_b^{occ}\int P_b(r_j)\ \frac{e^2}{r_{ij}}\ P_b(r_j)dr_j\right] &\quad P_a(r_i) \\
-\left[\sum_b^{occ}\int P_b(r_j)\ \frac{e^2}{r_{ij}}\ P_a(r_j)dr_j\right] &\quad P_b(r_i) \\
=\varepsilon_a &\quad P_a(r_i)
\end{aligned}
$$

$$
\psi(r,\theta,\phi,\sigma)=\frac{1}{r}P_{n\ell}(r)Y_{\ell m_\ell}(\theta,\phi)\chi_{m_s}(\sigma).
$$