

$$5.3 \quad k_B \rightarrow 0 \quad \hat{\sigma}_n \rightarrow 0$$

$$5.109 \quad \left(\mu_e - \frac{\Delta V}{2\rho} + \frac{1}{2} \hat{\sigma}_x^2 \right) A_e(\hat{x})$$

$$- i \int d\hat{\rho} d\hat{\eta} \int_{-\infty}^{\infty} dx e^{i(\nu \hat{\sigma} - \mu_e)x} \frac{\delta \bar{\Psi}_0}{\delta \hat{x}} A_e(\hat{x}) = 0$$

$$5.131 + 5.132$$

$$\frac{1}{2} \left[\frac{1}{\hat{r}} \frac{\partial}{\partial \hat{r}} \left(\hat{r} \frac{\partial}{\partial \hat{r}} \right) + \frac{1}{\hat{r}^2} \frac{\partial}{\partial \hat{\phi}^2} \right] A_e(\hat{x}) + \left[\mu_e - \frac{\Delta V}{2\rho} - \left(1 - \frac{\hat{r}^2}{2\hat{\sigma}_x^2} \right) \frac{1}{\mu_e^2} \right] A_e(\hat{x}) = 0$$

$$A_e(\hat{x}) = A_{e,m}(\hat{r}) e^{im\phi}, \quad y = \frac{i\hat{r}^2}{\mu_e \hat{\sigma}_x} \quad \left(-\frac{\eta}{\hat{\sigma}_x^2} \right)$$

$$\left[\frac{\partial}{\partial y} \left(y \frac{\partial}{\partial y} \right) - \frac{m^2}{4y} + \frac{\mu_e \hat{\sigma}_x}{2i} \left(\mu_e - \frac{\Delta V}{2\rho} - \frac{1}{\mu_e^2} \right) - \frac{y}{4} \right] A_{e,m} = 0$$

$$A_{e,m} = y^{m/2} e^{-y/2} \alpha_{e,m}(y)$$

$$y \alpha_{e,m}''(y) + (1+m-y) \alpha_{e,m}'(y) - \frac{1}{2} \left[m+1 + i\mu_e \hat{\sigma}_x \left(\mu_e - \frac{\Delta V}{2\rho} - \frac{1}{\mu_e^2} \right) \right] \alpha_{e,m}(y) = 0$$

$$m=0$$

$$y \alpha_{e,0}''(y) + (1-y) \alpha_{e,0}'(y) - \frac{1}{2} \left[1 + i\mu_e \hat{\sigma}_x \left(\mu_e - \frac{\Delta V}{2\rho} - \frac{1}{\mu_e^2} \right) \right] \alpha_{e,0}(y) = 0$$

$$\mu_e^2 \left(\mu_e - \frac{\Delta V}{2\rho} \right) - 1 = \frac{i\mu_e}{\hat{\sigma}_x} (2\ell+1)$$

$$\text{as } \hat{\sigma}_x \rightarrow 0 \Rightarrow \mu_e^2 \left(\mu_e - \frac{\Delta V}{2\rho} \right) = 0$$