6. Correlation effects

$$n = \frac{3}{4\pi r_s^3} \Rightarrow r_s = \left(\frac{3}{4\pi n}\right)^{1/3}$$

$$n \frac{d}{dn} \varepsilon_c = n \frac{dr_s}{dn} \frac{d\varepsilon_c}{dr_s} = -\frac{1}{3} r_s \frac{d\varepsilon_c}{dr_s}$$

$$\varepsilon_c = \begin{cases} \dfrac{\gamma}{1+\beta_1\sqrt{r_s}+\beta_2 r_s} & r_s \geq 1 \\ A\ln r_s + B + C r_s \ln r_s + D r_s & r_s < 1 \end{cases}$$

$$-\frac{1}{3} r_s \frac{d\varepsilon_c}{dr_s} = -\frac{1}{3} r_s \begin{cases} -\dfrac{\beta_1/2\sqrt{r_s} + \beta_2}{(1+\beta_1\sqrt{r_s}+\beta_2 r_s)^2}\gamma \\ \dfrac{A}{r_s} + C\ln r_s + C + D \end{cases}$$

$$V_c = \begin{cases} \gamma \dfrac{3+\frac{7}{2}\beta_1\sqrt{r_s}+4\beta_2 r_s}{3(1+\beta_1\sqrt{r_s}+\beta_2 r_s)^2} \\ A\left(\ln r_s - \frac{1}{3}\right) + B + C\left(\frac{2}{3} r_s \ln r_s - \frac{1}{3} r_s\right) + \frac{2}{3} D r_s \end{cases}$$