

$$Y(r_{12}) = \frac{1}{4\pi a^3} \frac{e^{-r_{12}/a}}{r_{12}/a} . \quad (4)$$

The distance between the interacting particles is  $r_{12}$  and the magnitude of their relative momentum is  $p_{12}$ . The average density  $\bar{\rho}$  is defined by

$$\bar{\rho}^{2/3} = (\rho_1^{2/3} + \rho_2^{2/3})/2 , \quad (5)$$

where  $\rho_1$  and  $\rho_2$  are the relevant densities of the interacting particles (neutrons or protons) at points 1 and 2. The dimensionless interaction strength parameters  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\sigma$  may be different for interactions between like and unlike particles, and the difference is described in our model by two parameters  $\xi$  and  $\zeta$ , as follows:

$$\begin{aligned} \alpha_\ell &= \frac{1}{2}(1-\xi)\alpha , & \alpha_u &= \frac{1}{2}(1+\xi)\alpha , \\ \left. \begin{array}{l} \beta_\ell \\ \gamma_\ell \\ \sigma_\ell \end{array} \right\} &= \frac{1}{2}(1-\zeta) \left\{ \begin{array}{l} \beta \\ \gamma \\ \sigma \end{array} \right. , & \left. \begin{array}{l} \beta_u \\ \gamma_u \\ \sigma_u \end{array} \right\} &= \frac{1}{2}(1+\zeta) \left\{ \begin{array}{l} \beta \\ \gamma \\ \sigma \end{array} \right. . \end{aligned} \quad (6)$$

Altogether there are thus seven adjustable parameters in the effective interaction:  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\sigma$ ,  $\xi$ ,  $\zeta$  and the range  $a$ . It turns out that binding energies and density distributions depend only on six parameters because, for these properties,  $\beta$  and  $\sigma$  always occur together in the combination  $B \equiv \beta + (5/6)\sigma$ .

#### 4. The optimum parameters

The parameter set that we have adopted (on the basis of the fitting procedures to be described) is as follows:

$$\alpha = 1.98483, \quad \beta = 0.15790, \quad \gamma = 1.10121, \quad \sigma = 1.05, \quad (B = 1.03290), \quad \xi = 0.25771, \quad \zeta = 0.53002, \\ a = 0.59346 \text{ fm.}$$