

Fig. 3. Radial dependencies of the u wavefunctions of the potentials with (a) $\lambda_w = -100 \text{ fm}^{-3}$ and -2000 fm^{-3} and (b) the potentials of Table 1 and the Reid (1968) hard-core potential near the hard-core radius.

and calculating the binding energy of the local part alone. The local part is relatively repulsive, e.g. the local part of the potential with the smallest $|\lambda_w|$ has a small binding energy of -1.087 MeV and the local parts with larger $|\lambda_w|$ are repulsive enough to exclude bound states.

The short-range structure found in the u wavefunctions of the potentials of Kermode *et al.* (1991*a*, 1991*b*) and in both the u and w waves of the potential



Fig. 4. Radial dependencies of the w wavefunctions of the potentials of Table 1 and of the Reid (1968) hard-core potential. Each graph is labelled with its value of λ_w (fm⁻³).

of Mustafa *et al.* (1992) has also been found in the w wavefunctions of the present work, as shown in Fig. 4. It is clear from Fig. 4 that the attractive short-range nonlocality which acts only in the D state increases the complexity of these short-range structures. Also, within the radial range r = 0.88 to 2.5 fm, the graphs in Fig. 4 representing the wavefunctions w of the D state are ordered monotonically by the nonlocality strength parameter λ_w . The Reid hard-core potential with no nonlocality ($\lambda_w = 0$) is at the top and the potential with $\lambda_w = -2000$ fm⁻³, having the largest nonlocal attraction, is at the bottom.

4. Conclusions

We have found that the D-state probability of the deuteron is sensitive in particular to the decrease caused by nonlocality in the w wavefunction at short radii where short-range structure occurs. The probability decreases smoothly with increasing strength of the attractive short-range nonlocality which acts only in the D state.

The potential of Kermode *et al.* (1991*a*) which incorporates attractive shortrange nonlocality only in the S state has a relatively large value for the D-state probability of $P_{\rm D} = 7.64\%$. The inclusion of this nonlocality in the D state, in addition to the S state, in the potential of Mustafa *et al.* (1992) may be partially the reason for its giving the smaller value of $P_{\rm D} = 6.29\%$, a result that one would expect from the findings of the present work.

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