

Fig. 14.1. The wave function $\varphi = s_2$ is symmetric with respect to the xy plane, i.e., the plane perpendicular to the z axis. The wave function $\varphi = p_2$ is antisymmetric. A superposition of both, the hybrid $\varphi = h_2$, displays neither symmetry nor antisymmetry: it is unsymmetric. Its absolute square, the probability density $|\varphi|^2 = |h_2|^2$, is markedly more extended along the negative z direction compared to the positive z direction.

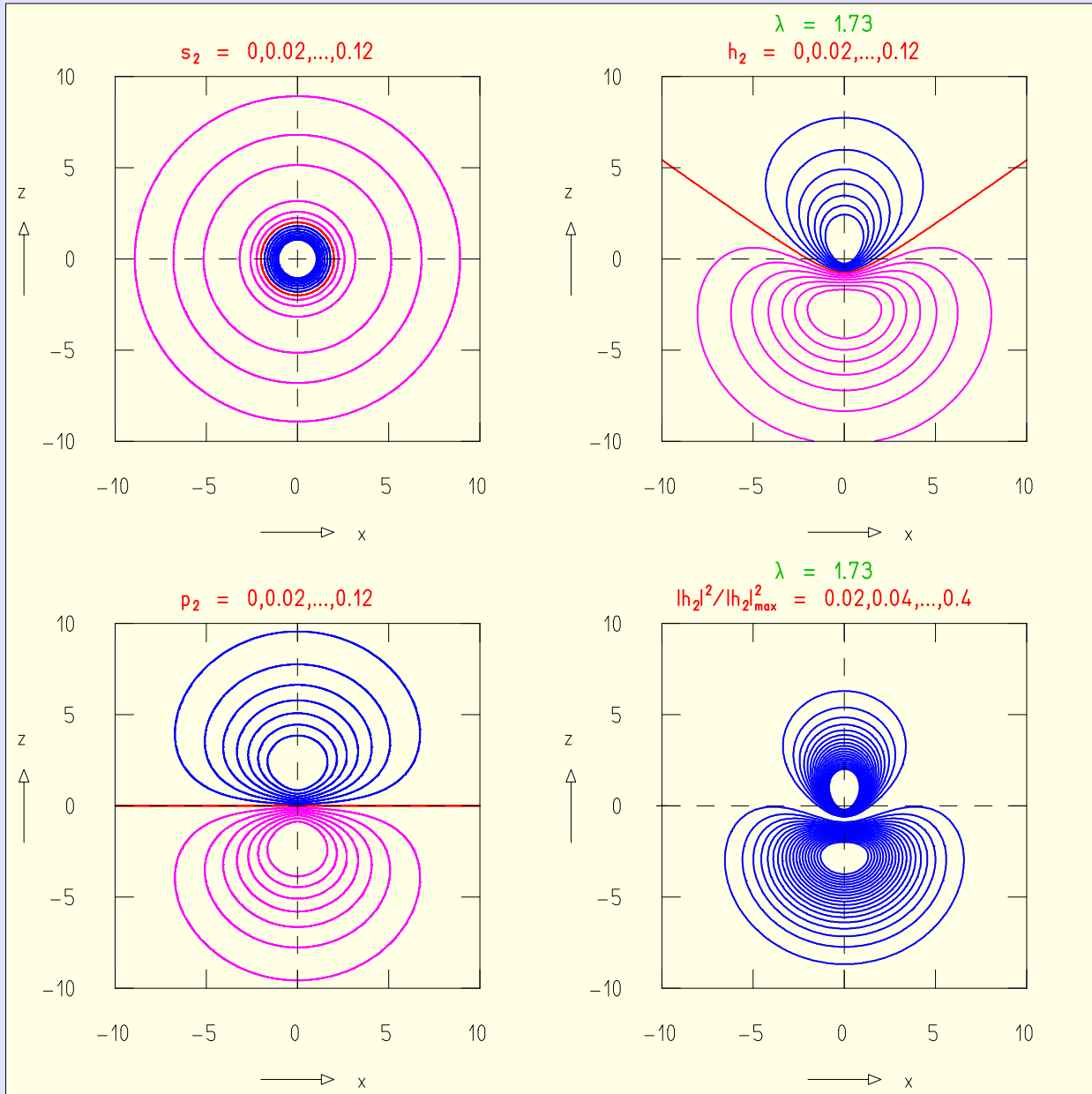


Fig. 14.2. The functions displayed in Fig. 14.1 are shown here in the form of contour plots in the xz plane. Function values are positive on blue lines, negative on magenta lines, and vanish on red lines. The unit length used for the scales in x and z is the Bohr radius.

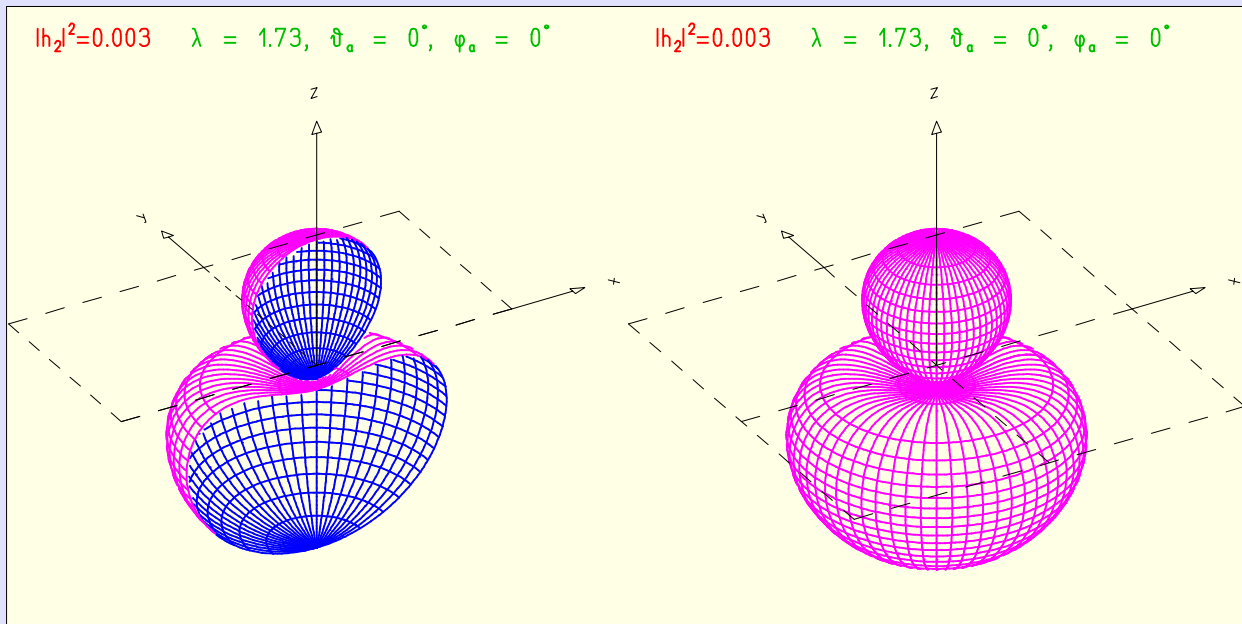


Fig. 14.3. The probability density shown in the bottom right of Figs. 14.1 and 14.2 is displayed here as a contour-surface plot. On the left it is shown for the half-space $y > 0$ only and thus appears as cut open. On the right the surface is closed since it is shown in full space.

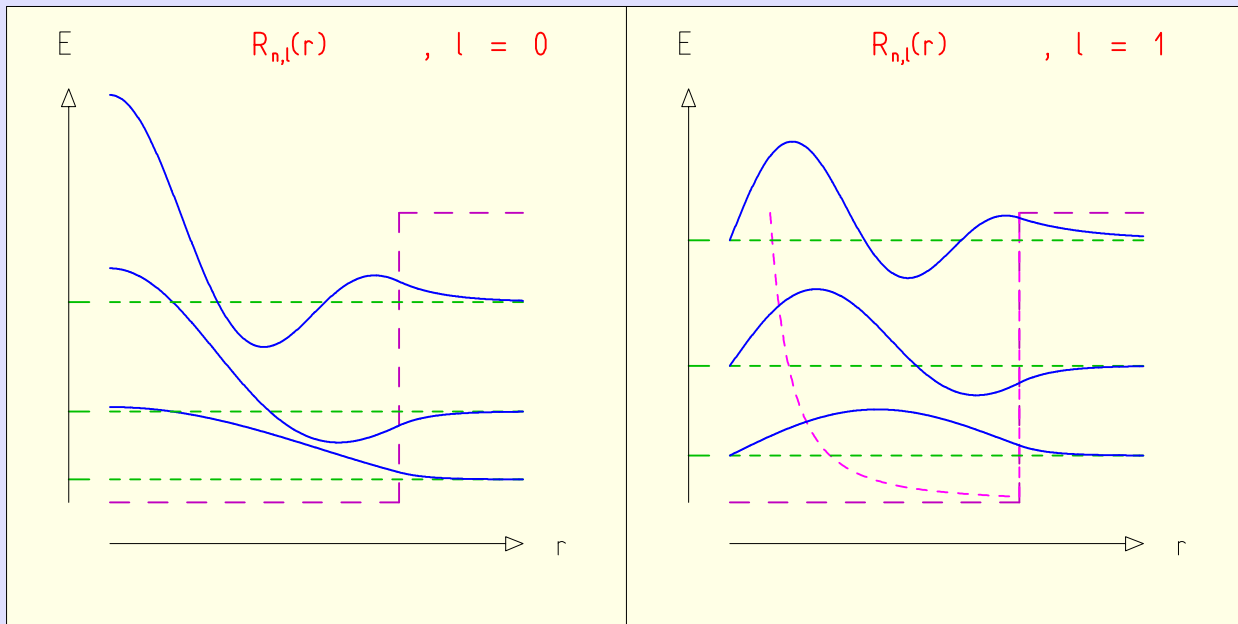


Fig. 14.4. Radial wave functions and their eigenvalues in a 3D square-well potential. The eigenvalues are systematically higher for states with $\ell = 1$ (right) compared to the corresponding states with $\ell = 0$ (left).

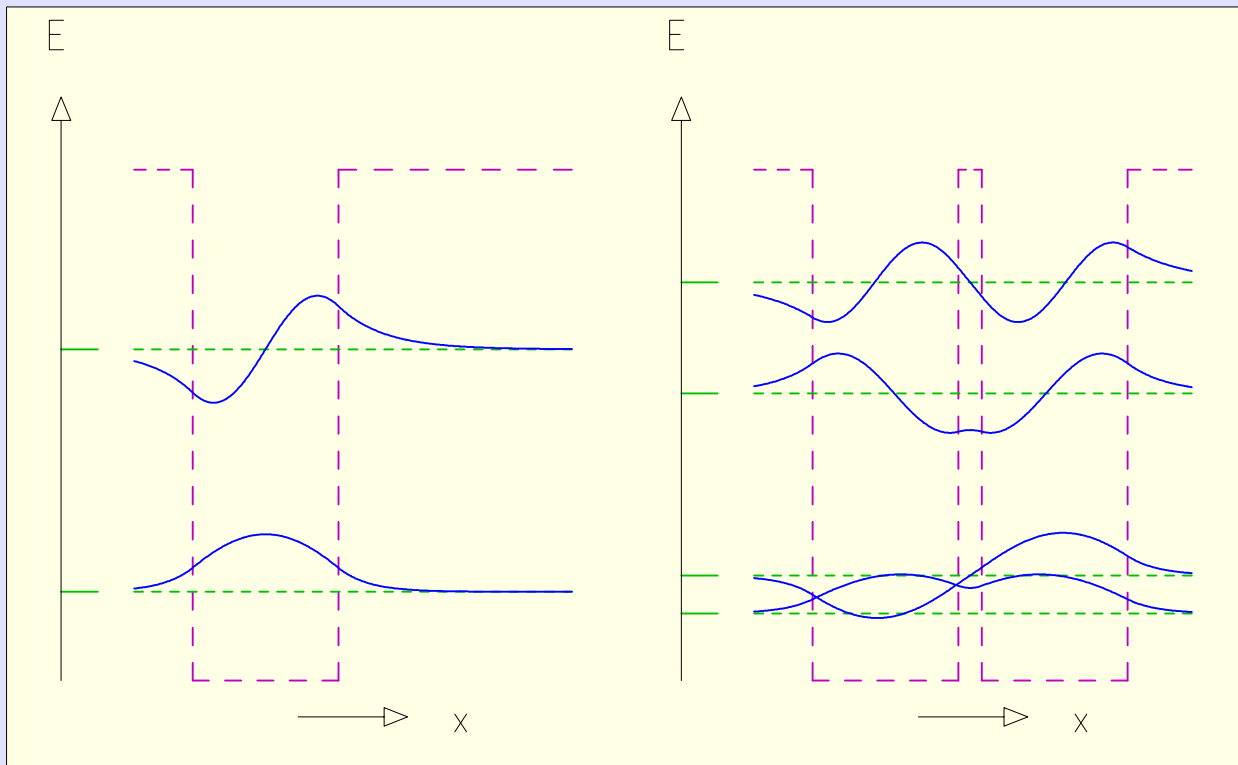


Fig. 14.5. Eigenvalues and eigenfunctions in a 1D potential. For every state in a single well (left), there are two states in the double well: one with lower, the other with higher energy than in the single well. The state of lower energy is *binding*, that of higher energy is *anti-binding*.

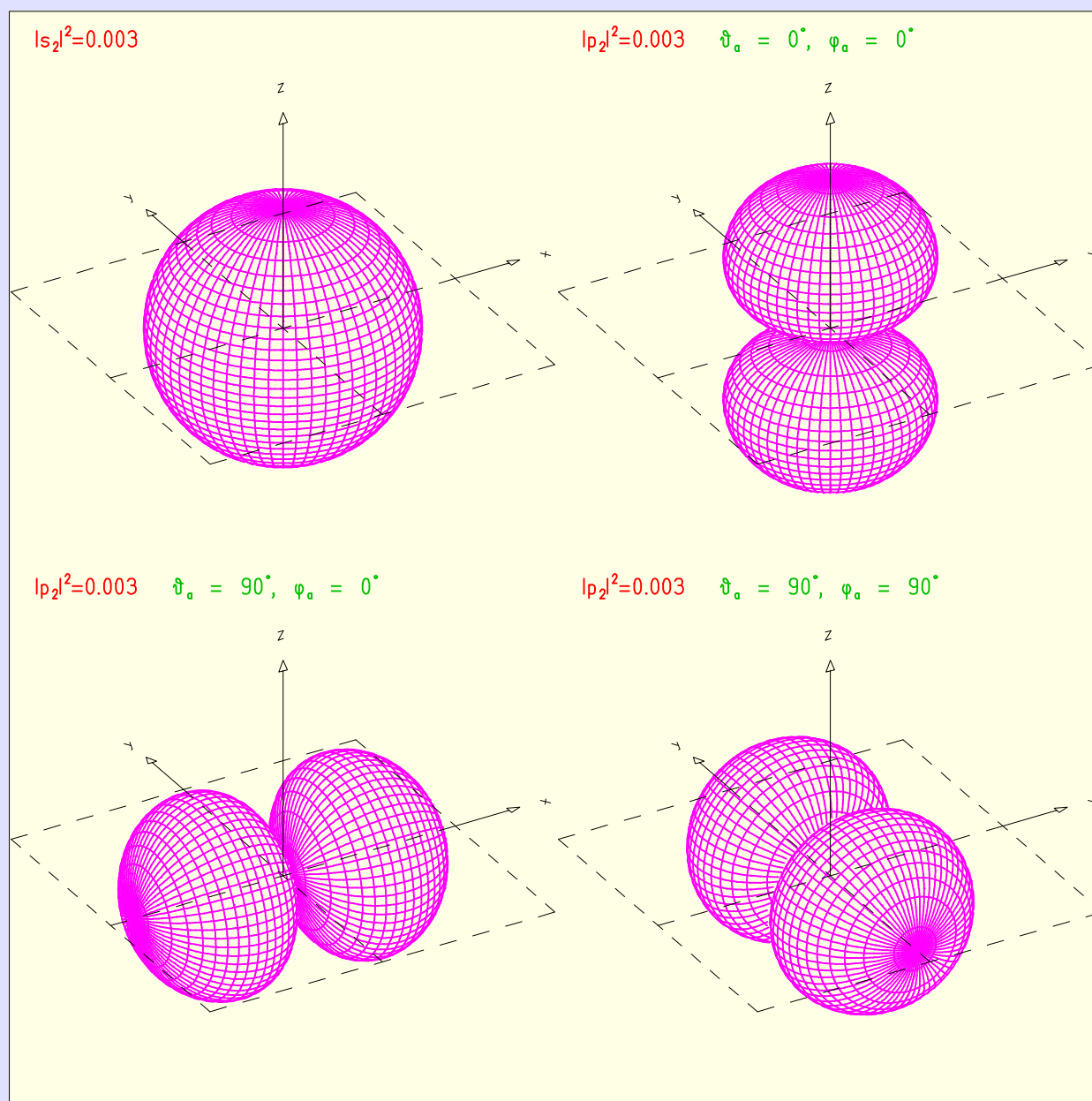


Fig. 14.6. Contour-surface plots illustrating the four orthogonal states $s_2, p_{2z}, p_{2x}, p_{2y}$.

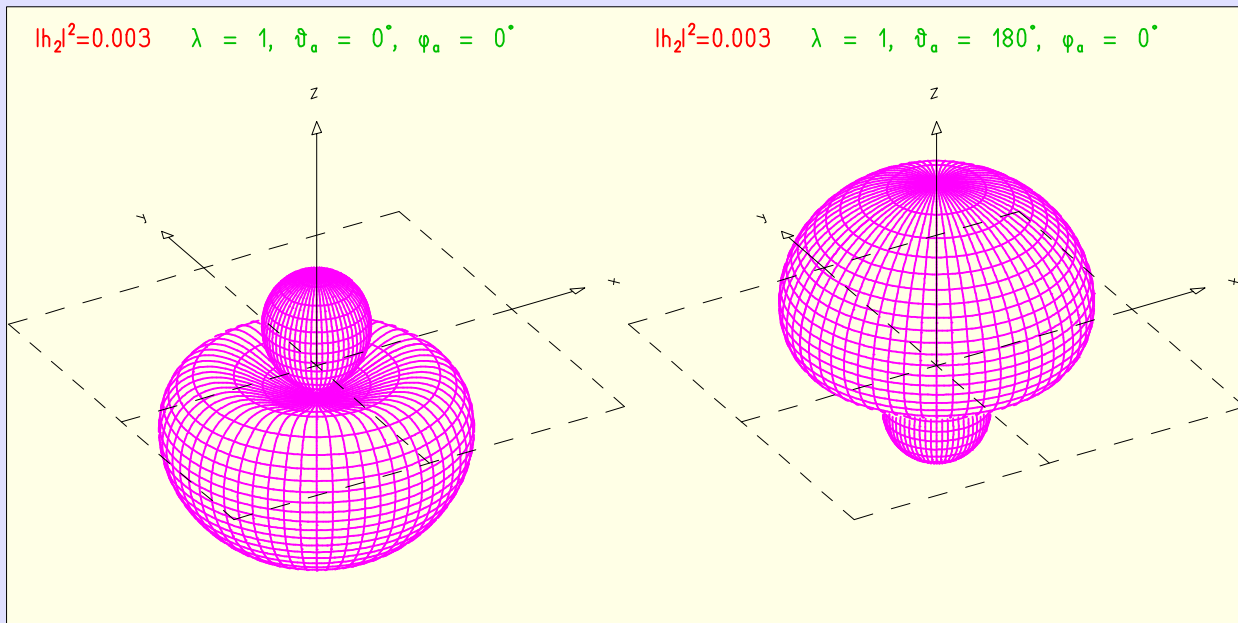


Fig. 14.7. *sp* hybrids for $n = 2$: Contour-surface plots of $|h_{21}|^2$ and $|h_{22}|^2$.

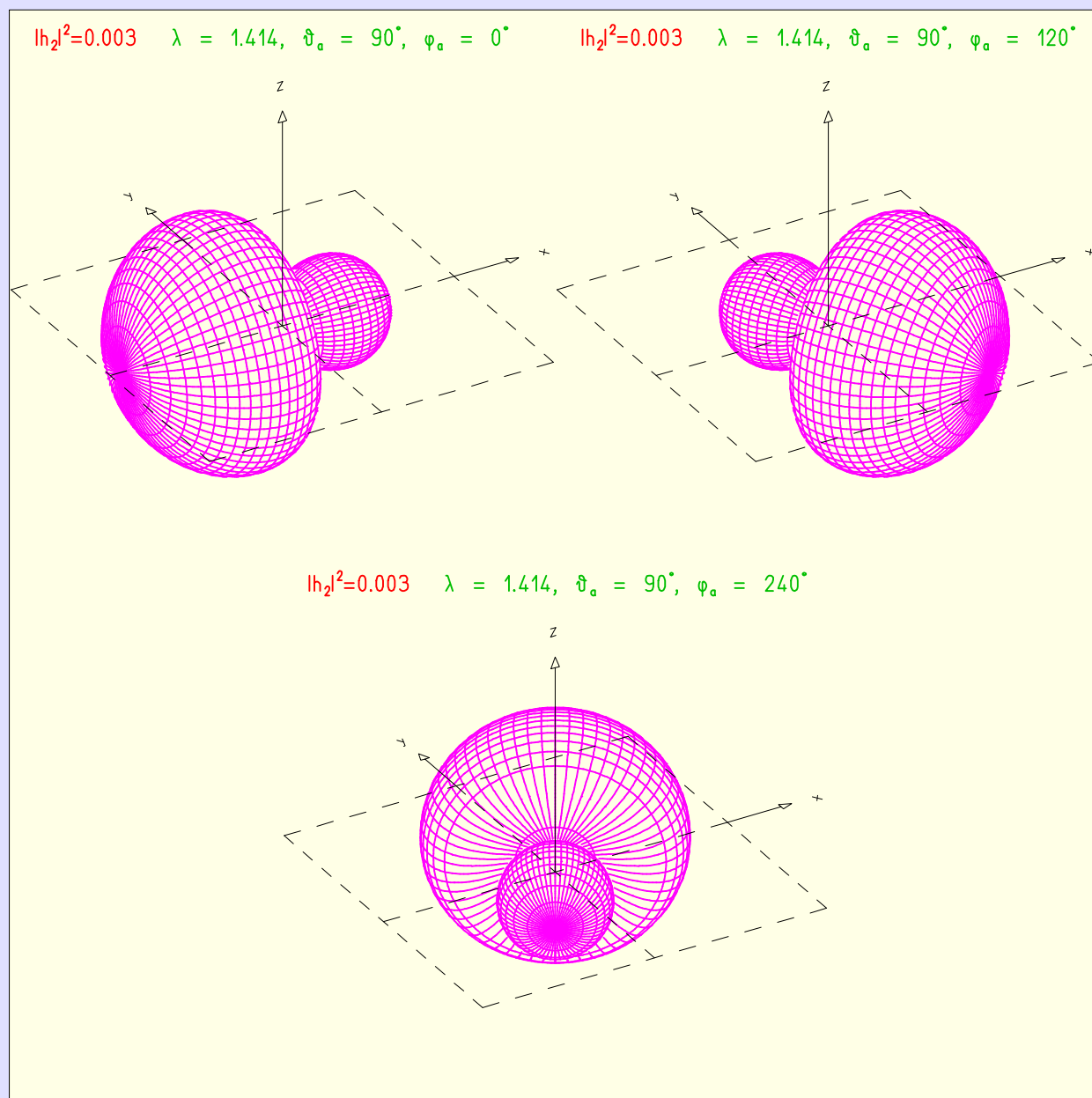


Fig. 14.8. Contour-surface plots of sp^2 hybrids for $n = 2$.

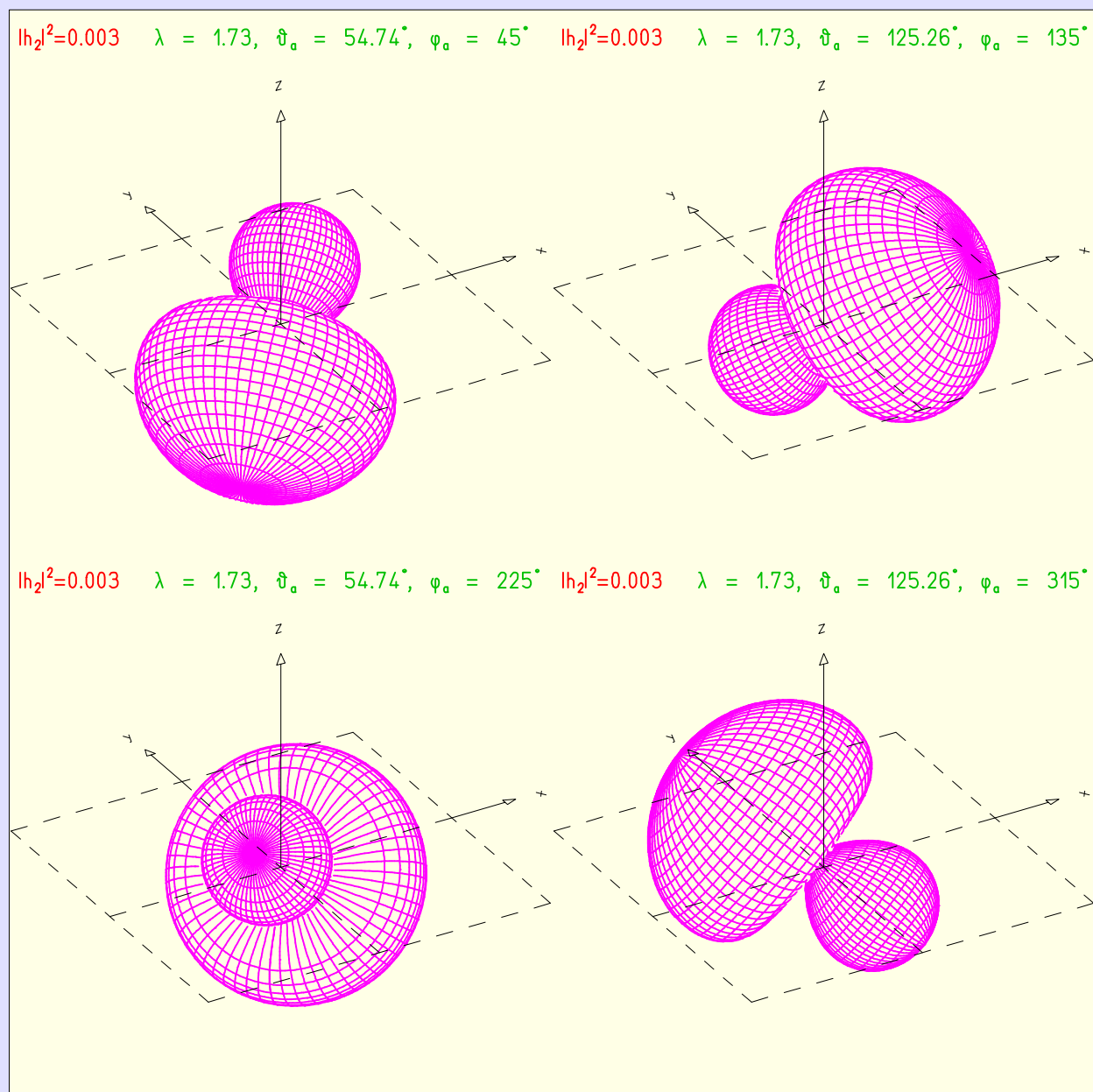


Fig. 14.9. Contour-surface plots of sp^3 hybrids for $n = 2$.

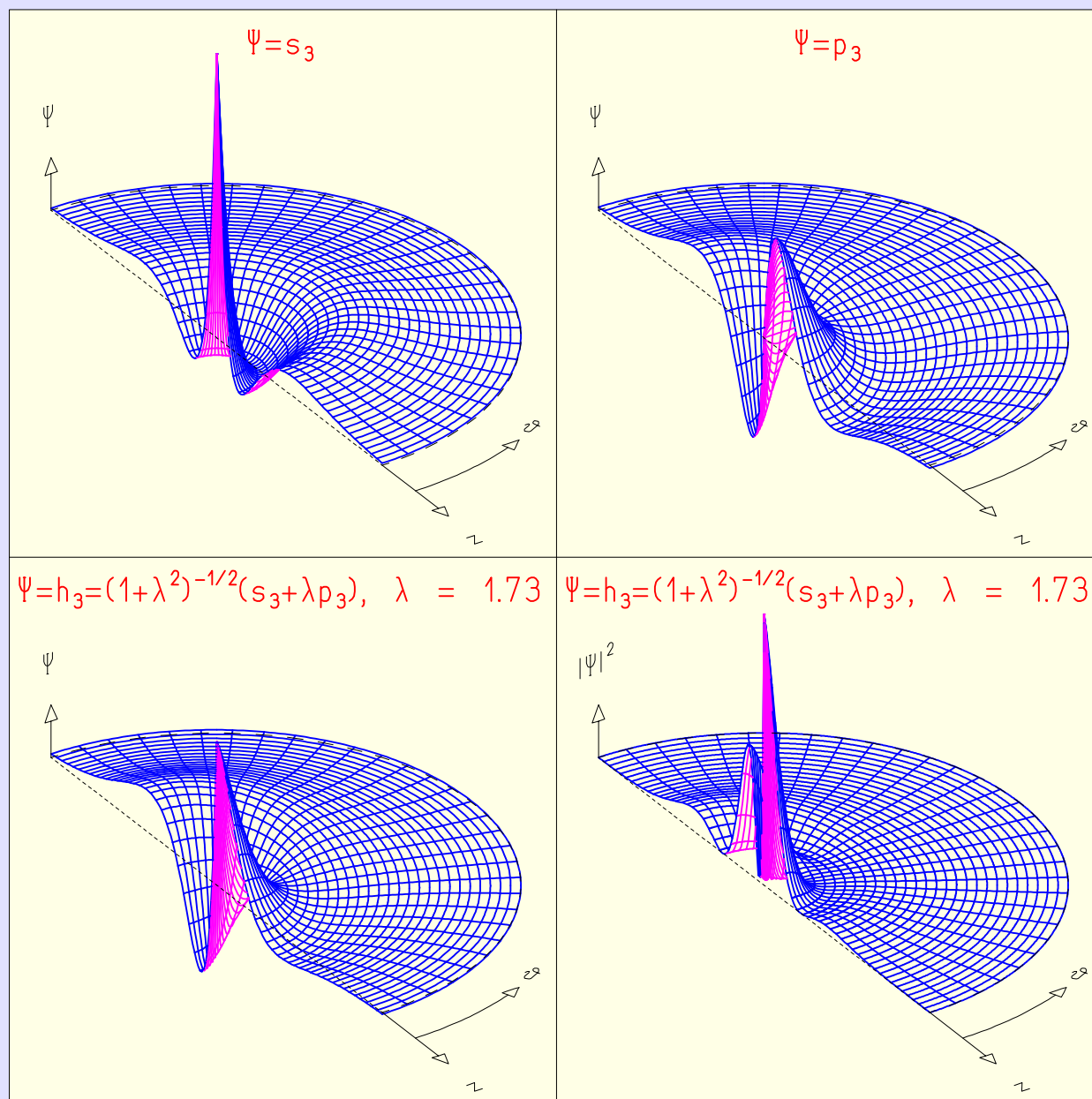


Fig. 14.10. The wave functions $\varphi = s_3$, $\varphi = p_3$, their superposition $\varphi = h_3$, and its absolute square, the probability density $|\varphi|^2 = |h_3|^2$. In comparison to Fig. 14.1 the scale in the $r\vartheta$ plane is different; the functions shown here extend over a wider region.

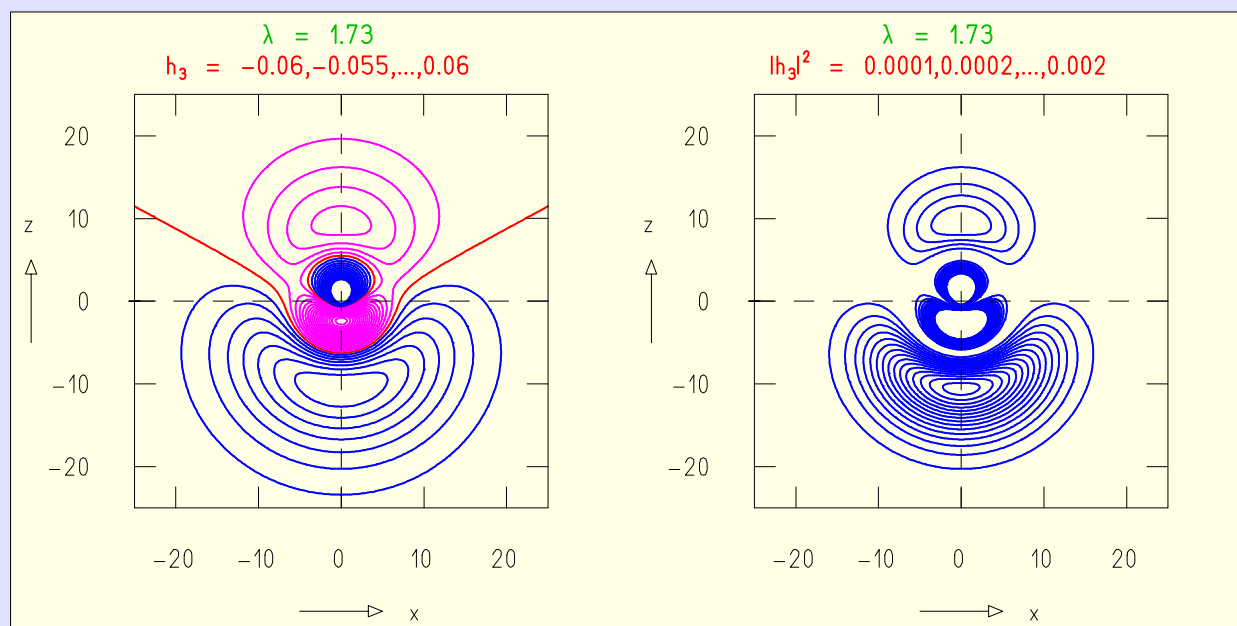


Fig. 14.11. The functions $\varphi = h_3$ and $|\varphi|^2 = |h_3|^2$ displayed in Fig. 14.10 are shown here in the form of contour plots in the xz plane. Function values are positive on blue lines, negative on magenta lines, and vanish on red lines. The unit length used for the scales in x and z is the Bohr radius. Note the difference in scale with respect to Fig. 14.2.

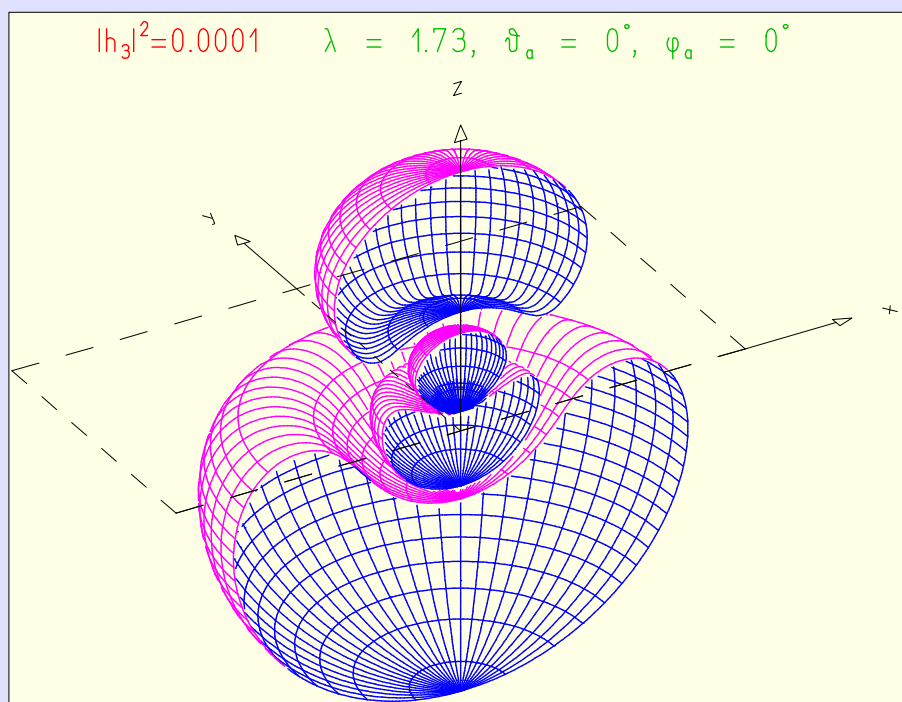


Fig. 14.12. The probability density of the sp^3 hybrid for $n = 3$ shown as contour-surface plot in the half-space $y > 0$.