

Transition densities of spin-dipole excitations in ^{208}Pb

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In recent papers [1], [2] the electric and magnetic spin-dipole responses of heavy even-even axial deformed and spherical nuclei were studied within the framework of the Wigner Function Moments (WFM) method. The energies and transition probabilities of $E1$ and spin $M2$ excitations of ^{164}Dy [1], ^{90}Zr and ^{208}Pb [2] were calculated. It was found that the spin degrees of freedom give rise to the isovector Electric Spin Dipole Resonance (ESDR). The ESDR is low-energy satellite of the isovector Giant Dipole Resonance (GDR) and is not excited if the spin-orbit potential is neglected.

The present work extends previous results by investigating transition densities. We analyze the transition densities associated with 1^- and 2^- excitations of ^{208}Pb . The main interest is to study the interplay of spin-flip and spin-scalar contributions to $E1$ transitions. It was found that the out-of-phase translational motion of protons and neutrons dominates for both, GDR and ESDR. The corresponding displacements are localized in the surface layer of the nucleus. The contribution from spin-flip is also localized primarily near the surface. However, there is also an appreciable contribution from the interior region. In the case of the ESDR, the overall contribution of spin-flip is significantly more pronounced compared to that obtained for GDR. Transition densities for isoscalar and isovector magnetic spin-dipole 2^- excitations are also discussed.

References

1. E. B. Balbutsev, I. V. Molodtsova, *Natural Sci. Rev.* **3**, 100703 (2026).
2. E. B. Balbutsev, I. V. Molodtsova, *Int. J. Mod. Phys. E* **35**, 2641007 (2026).