Scattering of proton by Lithium atom with exchange of electron

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In this work, we develop a special perturbation theory, called the exchange perturbation theory (EPT), which takes into account the indistinguishability of electrons participating in multi-center atomic and molecular collisions at any order of perturbation. For the scattering problems of complex (atomic, molecular) particles, the S-matrix of scattering and the T-matrix of transition are introduced in a consistent way, which include exchange contributions arising from the consideration of inter-center permutations of electrons in colliding particles. It is worth noting that the development of EPT requires a thorough study of the wave functions associated with electrons located in different atomic centers.

Next, we will consider collisions involving the redistribution of electrons, such as the collision of a proton with a lithium atom. The initial state is described by a vector corresponding to the initial permutation of electrons between centers, and the antisymmetric vector of the final state is obtained by applying the normalized Young operator to the wave function with respect to all permutations of electrons between the centers. The expressions for the matrix elements of the transition from the initial state to the final state contain contributions due to the intercenter permutations of electrons. The dependence of the differential cross section on the proton energy and the scattering angle has been obtained.

References

1) Orlenko E.V., Evstafev A.V., Orlenko F.E. 2015, *Journal of Experimental and Theoretical Physics* 147 338.