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Positron scattering by lithium atom with electron exchange

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We present the formalism of Time-dependent Exchange Perturbation Theory (TDEPT) built to all orders of perturbation, for the arbitrary time dependency of perturbation. The theory takes into account the rearrangement of electrons among centers. The elements of the scattering S-matrix and transitions T-matrix and the formula for the electron scattering differential cross section are derived. The application of the theory to scattering and collision problems is discussed as an example of positron scattering on a lithium atom, calculating the differential and total cross-sections. The strength of the interaction between particles during collisions is described by a scattering cross-section, or by an effective cross-section. We consider the collision associated with the redistribution of electrons, as the collisions of positrons with neutral atoms accompanied by charge transfer. The obtained matrix element contains the exchange integrals. These integrals take into account the permutations of the electrons between the centers (Li and positron). The signs of these integrals are defined by the Young diagrams and depend on the total spin value. At a simulated differential cross section as a function of the scattering angle at different energies of the incident positron, one can observe regions of a "twisted ridge" for certain values of wave vector k and a scattering angle θ. It has been previously reported that under similar conditions, when an alpha-particle is colliding with a lithium atom, the differential cross-section has a smooth appearance without ridges. The same "twisted ridge" were theoretically predicted for the scattering of proton by lithium atom, for other values of vector k and angle θ.

Biography

Elena V Orlenko has completed her PhD from St. Petersburg State Polytechnic University. She is a Full Professor in Theoretical Physics Department and Director of a research team focusing on "Spin ordering in the system of identical particles with high spins and scattering processes of atomic particles with electron exchange" at Peter the Great St. Petersburg Polytechnic University.

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