Density matrix in description of the collision of atomic particle with solid film

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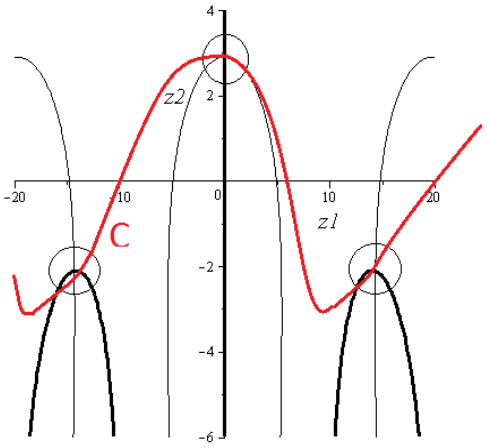
Abstract

Calculation and further analysis of density matrix (DM) for projectile which collides with a solid film reveals some new representations which is hard to be anticipated without the calculation namely: The coherence properties in the projectile's wave field are describing through the special function of coherence. The collision with the solid leads to a significant decrease in the total coherence length of the projectile's wave field. The coherence length can become much smaller than the initial size of a wave packet of a particle passing through the film. During the collision with solid the number of different spatial areas where the mutual coherence in the projectile's wave field is supported, can be multiplied. Every part of projectile's wave field can be individualizing as the separate particle having own property in its inner quantum state. The procedure which has a responsibility for such a transformation can be characterized as a spontaneous breaking of symmetry. The process described in the point 3 can be considered as a special form of breaking in quantum mechanics. Knowing the wave packet evolution during the passage through the solid film allows one to explain experimental results on the pore formation during the passage of high charged atomic ions through the thin carbon nano-membranes. The parts of the wave field considered above can be stabilized in its quantum state after it has been captured in its own polarization well.

Image



Recent Publications

1. G M Filippov (2015) Passage of a charged particle through a thin solid film. Nuclear Inst. and Methods in Physics Research B 354:177-182.

2. G M Filippov (2015) Role of spatial dispersion in defining the image of a point charge near the dielectric surface. Nuclear Instruments and Methods in Physics Research Section B. DOI: 10.1016/j.nimb.2015.03.036.

3. G M Filippov, V A Aleksandrov (2016) Calculating the probability of pore formation by multicharged ions incident on an ultrathin film. Bulletin of the Russian Academy of Sciences: Physics 80 (2):125–128.

4. G M Filippov (2014) Mixed states of quantum particles and criterion of coherence. Bulletin of the Russian Academy of Sciences: Physics 78(6): 563–567.

5. VA Aleksandrov, A S Sabirov, GM Filippov (2015) Some peculiarities in an electron conductivity in a system of

quantum dots**.** Nuclear Instruments and Methods in Physics Research 47 (12).

Biography

Gennadiy Filippov has his expertise in particle-solid interaction physics. He has completed his PhD from Tomsk State University (Russia). He is the Head of the Laboratory of Biophysics and Bio-Nanotechnology in the Chuvash State Agricultural Academy and Professor in the Chuvash State Pedagogical University in Cheboksary, Russian Federation.

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