Effect of Polarization Phenomena on Interaction of Projectile with a Solid Target

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The effect of intense and prolonged impact on the wave field of a projectile upon invasion into the volume of a solid is considered. There is some significant difference between classical and quantum particle consequences of such an invasion. Instead of the rapid and considerable chaos of the flow of classical particles bombarding a certain surface layer of a solid, which is expressed in particular in the presence of a certain cascade of collisions and the corresponding splitting of the incident flux into various independent branches of secondary flows, the wave field of the incident quantum particle has some stability, which cannot be understood on the basis of simple classical considerations. The degree of mutual coherence calculated by means of the density matrix of the projectiles wave field, initially having a large coherence length, does not undergo immediate rapid changes, varies more slowly compared to the rate of change in the characteristics of the flow of classical particles. The wave field has a certain protection, due to the existence of the polarization field, which each particle creates around itself through interaction with the surrounding medium. Calculations show that a possible cause of the decay of the wave field into uncorrelated parts is a violation of the degree of coherence caused by the generation of a set of uncorrelated random excitations of the environment, mainly its low-energy component. As energy and momentum fluctuations accumulate in the uncorrelated part of the wave field excitations, this part reaches a critical size, leading to a significant decrease in the coherence length and, consequently, to the decay of the particle. The detailed mechanism of such the process needs further study.