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

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In a number of current investigations within the scope of modern physics the time-resolved experiments and consequence theories play a central role in understanding of physical phenomena. As an important example consider the detailed information about the particle-solid and particle- nucleus interaction physics. As an example of such a situation emphasize the next results:

1. The collision with solid leads to a significant decrease in the total coherence length of projectile's wave field. The coherence length can become much smaller than the initial size of wave field of projectile.

2. 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.

3. The 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.

4. The process described in the point 3 can be considered as a special form of breaking in quantum mechanics which can in principal explain a mechanism of nuclear breaking.

As an example consider the particle-atomic chain interaction phenomenon. Consider the passage of hydrogen atom parallel to the chain of seven carbon atoms (see figure). We observe a splitting the electron's wave packet during the passage. When the coherence length becomes less the interatomic distance we come to conclusion that among several points of electron localization must survive only one. How we can understand the detailed mechanism of such a transition? That problems tightly connected to famous wave function reduction problem and in principal can be solved with the help of estimating the time-evolution of density matrix.

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