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Formation and Application of Coherent Correlated States of Charged Particles at Action of Weak Electromagnetic Field and During Orientation Motion of Particles in Periodic Structures

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In the report the universal method of short-term and very significant suppression of the tunneling effect and very essential optimization of nuclear interaction of low-energy particles by the use of coherent correlated states [1-10] formed by weak controlled external action on these particles is discussed. The main factor of such process is connected with the self-similar synchronization of weak fluctuations in the quantum superposition state of a particle and the generation of giant synchronized fluctuations of momentum and kinetic energy, sufficient for the realization of effective nuclear processes. The action of this mechanism can increase the transparency of the potential barrier for low energy particles by $10^4 \cdot 10^5 \cdot 10^6$ and more times. The most important characteristics of such states is the possibility of the existence of a giant fluctuation of the kinetic energy of the particle for a long time, sufficient for the reaction to proceed.

This mechanism explains practically all detected features of successful nuclear experiments conducted in numerous laboratories at low energy:

- a) anomalously high probability of these reactions at low energy of interacting particles;
- b) very significant suppression (as compared to similar reactions at high energy) of the accompanying gamma radiation;
- c) complete ban on “radioactive” channels of nuclear reactions and total absence of radioactive daughter isotopes, which may be formed in analogous reactions occurring without the use of coherent correlated states.

The possibility of formation an effective coherent correlated states under the influence of a pulsed [1-5,8-11,12] or periodic [4-9,11,12] electromagnetic fields on particles (including action of damping and fluctuations [6]) is also considered in this work. The efficiency of this process during the motion of low-energy particles through periodic structures (including the motion of particles in the crystal lattice field in the channeling regime [11,12]) is considered in details.

It is important to note that the method of coherent correlated states allows to explain, justify and numerically consider all known low energy nuclear reaction paradoxes without applying new radical hypotheses, basing only on the powerful foundations of modern quantum theory and nuclear physics.

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