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The Features of Propagation and the Remote Collapse of the Correlated Wave Packet

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In atomic and nuclear physics the state of moving particles is usually described by idealized plane waves. Such model is approximate and characterizes the features of such particles with some inaccuracies.
A real alternative is to describe the particle as a moving localized wave packet. The main disadvantage of this description is the instability and continuous "spreading" and delocalization of the package, which does not allow using it for the analysis of real physical processes. Such packet corresponds to an uncorrelated superposition of spectral components, which form this packet.
We consider the method of formation and features of the propagation of a correlated wave packet, which has the same initial form as an uncorrelated packet, but fundamentally different properties.
It is shown that, in contrast to the "standard" uncorrelated packet, for a correlated packet at the initial stage a self-simulated self-compression process proceeds to the collapse state at a given (controlled) removed distance. The spatial width of the correlated packet for a time of collapse decreases from the initial value to the controlled minimum value (the state of collapse of the wave packet) and then increases monotonically.
Simultaneously with the decrease of the width of the packet, up to the region of collapse, the amplitude of the packet sharply increases in time from the initial small value by many orders of magnitude to the maximum value, after which the accelerated "spreading" takes place.
The evolution of the correlated packet leads to a very sharp increase of the fluctuations of kinetic energy of the particle in the region of collapse to a value, which can exceed its average kinetic energy by many orders of magnitude at large value of correlation coefficient of [1].
The considered features of correlated wave packet evolution make it possible to predict the possibility of using it for a number of applied and fundamental problems. In particular, it is possible to control area of collapse of this packet in such a way that it would release of the maximum energy in a specific remote area of some target. These features of the correlated packet can also be used to realize nuclear fusion at a low mean energy of a particle.
The methods of formation of such correlated wave packet are also discussed.

1. V.I.Vysotskii, M.V. Vysotskyy, European Phys. Journal. 2013, A49, 99.

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