Using the Method of Coherent Correlated States for Realization of Nuclear Interaction of Slow Particles with Crystals and Molecules

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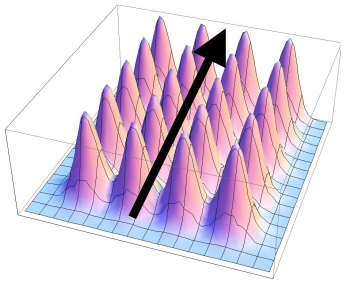
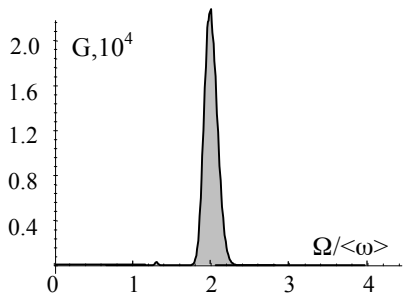
In the report the possibility and peculiarities of effective nuclear fusion based on the interaction of low energy proton beams with the nuclei of the crystal surface or gas of free molecules are discussed. In [1-4] a general and universal mechanism for LENR optimization based on the application of coherent correlated states (CCS) of interacting particles was considered. This mechanism provides a high probability of LENR and can be applied with the same efficiency to different experiments. It should be noted that the CCS method makes it possible to explain different LENR paradoxes on the basis of standard quantum mechanics and modern nuclear physics without involving fantastic heuristic models. The physical basis of this method is related to the Schrödinger-Robertson uncertainty relation $\delta p \delta x \geq \mathrm{h}/2\sqrt{1-r^2} \equiv G\mathrm{h}/2$, where $|r|\leq 1$ is a *correlation coefficient* and $G = 1/\sqrt{1-r^2}$ is the *coefficient of correlation efficiency*. In the works [1-3] it was shown that the mechanism of the formation of CCS with sharp increase of G up to $G \geq 10^3 \div 10^4$ can be realized when the particle is localized in the field of a nonstationary harmonic oscillator. In particular, the maximum rate of G increase corresponds to the case when the oscillator modulation frequency Ω is twice the average frequency ω of the oscillator. In this case if the particle is localized in a potential well with a width $\delta x = L$, then the kinetic energy fluctuations $\delta T^{(\min)} = (\delta p)^2/2m = G^2\mathrm{h}^2/8mL^2$ are very large.

This mechanism can be successfully implemented when, for example, a proton moves in the periodic field of crystal with the period d (Fig., left). In the rest system of the proton such motion corresponds to a nonstationary harmonic oscillator with the frequency $\Omega = vd$. In this case (e.g. in Li crystal with $<\omega> \approx 6.10^{14}\, s^{-1}$) the optimal condition for CCS formation corresponds to the optimal proton velocity $v_{opt} = 2<\omega>/d \approx (3 \div 4).10^7\, cm/s$ and optimal longitudinal energy $E_{opt} = mv_{opt}^2/2 \approx 500\, eV$ of the moving proton.





It was shown that at such condition the correlation efficiency of moving proton reaches a very large value $G \geq 25000$ (see Fig., right) to the end of $3^{rd} \div 4^{th}$ periods of the crystal lattice, which leads to the generation of giant fluctuations $\delta T^{(\min)} \geq 30\, keV$ of transverse energy of the particle and realization of $Li^7 + p = 2He^4$ reaction. Nearly the same effect, but with some differences, takes place when a slow proton moves through the inhomogeneous (nonstationary in a rest system) field inside a single Li_2 molecule.

All these results are in good agreement with very interesting experimental data [5].

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