Subbarrier Processes in LENR for Particles in Correlated States at Action of Damping and Fluctuations

#V.I.Vysotskii, M.V.Vysotskyy

It is well known that the presence of high and wide Coulomb barrier is the main obstacle to LENR. The method of the formation of coherent correlated state (CCS) with correlation coefficient $|r|\to 1$ of a particle, which can be used to giant increase of the transparency of this potential barrier

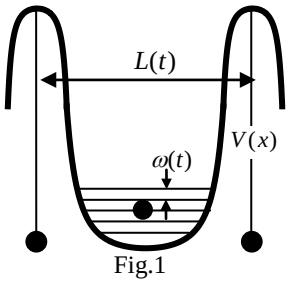

Fig.1

from very small values $D_{|r|=0}\approx 10^{-70}...10^{-1000}$ up to $D_{|r|\to 1}\approx D_{r=0}^{\sqrt{1-r^2}}\to 1$ was considered in [1–3]. The uniqueness of this method is connected with the fact that the transparency of the barriers ("walls" of a potential well with a particle) and the probability of LENR can be increased using a simple procedure of CCS formation: periodic modulation of the well width for the same barrier height $L(t)=L_0(1+g\cos\Omega t)$, $\omega(t)=\omega_0(1+g\cos\Omega t), g<<1$. The physical mechanism of the increase of barrier transparency for a CCS is associated with synchronization and periodic phasing of fluctuations of momentums $\Delta\vec{p}_n(t)$ of different eigenstates in the given quantum-mechanical system. The presence of external stochastic perturbation can violate the phase relations between different eigenstates and may affect the formation of the CCS, determining both the rate of the increase in |r(t)| and the value of $|r_{max}|$. Another essential negative factors are the damping of these oscillations and anharmonicity at growth of amplitude of these oscillations at periodic modulation.

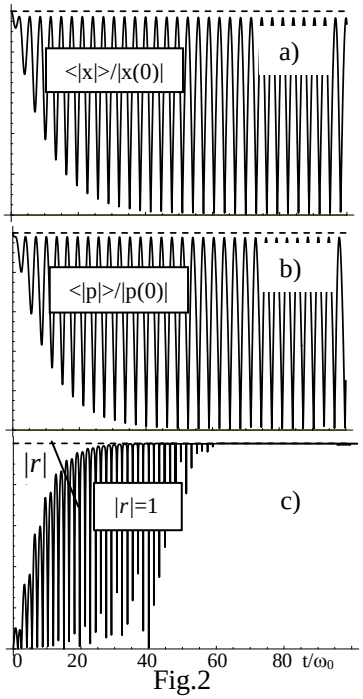

Fig.2

We consider peculiarities of the formation of CCS of a particle in a periodically modulated potential well with damping for various types of stochastic perturbation. It was shown that at the absence of stochastic perturbation, an optimal relation $g=2\gamma$ exists between the damping coefficient γ and the modulation depth, for which the "extrinsic" characteristics of the oscillator (amplitudes $<|x|>$ of "classical" oscillation and the momentum $<|p|>$ of a particle) remain unchanged and small, while the correlation coefficient rapidly increases from $r=0$ to $r\to 1$; this corresponds to completely CCS (Fig.2,a,b,c). It was shown that for optimal condition $g<2\gamma$ the presence of a stochastic delta-correlated $<f(t_1)f(t_2)>=2S\delta(t_1-t_2)$ force $f(t)$ substantially affects the rate of increase of normalized amplitude of oscillations, as well as the absolute value of correlation coefficient with time, but does not affect the final value $|r|\to 1$ and giant increase of the transparency $D_{|r|\to 1}\to 1$! These effects can be used for LENR optimization in real physical systems at action of damping and fluctuations.

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[2]. V.I.Vysotskii, M.V.Vysotskyy, S.V. Adamenko, "Formation and application of correlated states in nonstationary systems at low energies of interacting particles". Journal of Experimental and Theoretical Physics, v. 114, no. 2, pp. 243–252, 2012.
[3]. V.I. Vysotskii, S.V. Adamenko, "Low energy subbarrier correlated nuclear fusion in dynamical systems", Journal of Condensed Matter Nuclear Science, v.8, pp. 91-104, 2012.