Generation and Registration of Undamped Temperature Waves at Large Distance in LENR Related Experiments

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In the report the results of generation, detection and study of fundamentally new physical phenomena (*undamped high frequency temperature waves*, which can exist in different environments only at certain frequencies) are presented and discussed. These phenomena were found during experiments on the study of LENR processes at water jet cavitation [1-4].

A few years before these observations we carried out a detailed study of the features of thermodynamics in real environments [1,2]. In these studies it was shown that the equations of thermodynamics, in particular, the equation of thermal diffusivity $\partial T(r,t)/\partial t = G div\{grad[T(r,t)]\}$, contain approximations that are incorrect in media with a long thermal relaxation time τ. The solution of this "traditional" equation is a superposition of plane waves

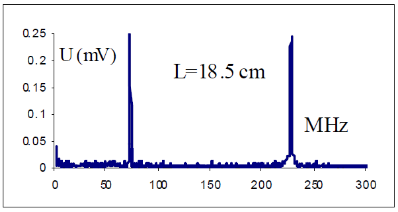
$$T(\omega,x,t) = A_\omega e^{-\delta x} e^{i(\omega t-\kappa x)} + B_\omega e^{\delta x} e^{i(\omega t+\kappa x)},\ \kappa = \sqrt{\omega/2G},\ \delta = \sqrt{\omega/2G}$$

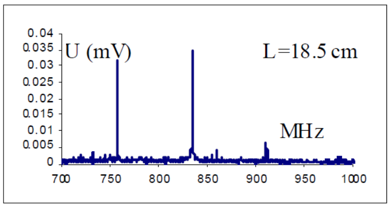
where G is a thermal diffusivity coefficient. This solution shows that temperature waves produced on the basis of uncorrect equation are characterized by a very strong damping with a factor $\delta = \sqrt{\omega/2G}$, which is equal to the wave number κ.

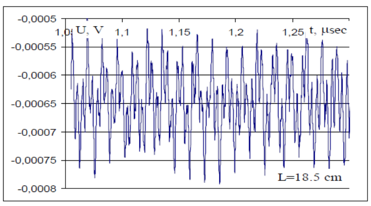
The solution of modified equation of thermal diffusivity $\partial T(r,t+\tau)/\partial t = G div\{grad[T(r,t)]\}$ [1-4] is

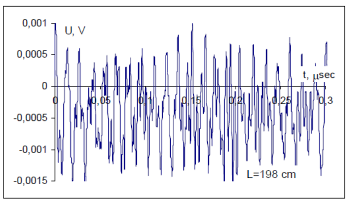
$$T(\omega,x,t) = A_\omega e^{-\delta^* x} e^{i(\omega t-\kappa^* x)} + B_\omega e^{\delta^* x} e^{i(\omega t+\kappa^* x)},\ \kappa^* = \kappa\cos\omega\tau/\sqrt{1+\sin\omega\tau}\ ,\ \delta^* = \kappa\sqrt{1+\sin\omega\tau}$$

For the waves with frequencies $\omega_n = (n+1/2)\pi/\tau$, which correspond to condition $\cos\omega_n\tau = 0$, the damping coefficient δ is equal to zero, and the general solution of this equation has the form of a superposition of the direct and inverse undamped temperature waves. In the air, under normal conditions, the minimal frequency of such wave corresponds to 70÷90 MHz and in metals and semiconductors it is 1÷100 THz. In our experiments these waves are generated via cavitation processes and registered in the air at a large distance that is limited only by the experimental conditions. The spectrum of these waves and their structure at different frequencies and different distances from the cavitation zone (at L=18.5 cm and L=198 cm) are shown in figures. In LENR processes in metal matrix such waves with $\omega \approx 10 \div 100\,THz$ can be excited at local fast processes similar to $Li^7 + p = 2He^4$ reaction.









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