

# Nanoscale physics

## Nonlinear properties of critical nano-fluid for the novel technologies

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Series of nonlinear physical phenomena occurring in an inhomogeneous critical nano-fluid (CNF) under internal inhomogeneous electromagnetic field  $|\Delta U(h)| \gg |h|$  oriented by external field of the Earth gravity  $h = \rho_c g \Delta z / P_c$  have been studied earlier [1]. A new method [2] of altitudinal gradient measuring of the internal field  $dU/dh$  using micro-floating gauge [3] has been proposed. It has been shown [4] that under the influence of the field  $|\Delta U(h)| \gg |h|$  in CNF light beams passing through the spatial inhomogeneity of the system are focused or defocused; changes in the critical temperature  $T_c$  and in the critical index of the coexistence curve  $\beta$  [5] are taking place.

Using the experimental data of scattered light intensity the structural and fluctuation characteristics of CNF have been calculated: correlation length ( $R_c$ ), number of fluctuations of the order parameter per mole ( $N_f \sim R_c^{-3}$ ), density within the order parameter fluctuation ( $\rho_f \geq 3\rho_c$ ), pressure in fluctuation volume ( $P_f \approx 10^2 P_c$ ), great thermodynamic potential ( $\Omega = -P_f V_c$ ) and its fluctuation part ( $F_f = N_f k_B T$ ). Using the calculations it has been shown [5] that during the decay of fluctuations of the order parameter the molecules of substance scatter with rates of spread  $v \approx 10^6 \div 10^7$  cm/s, comparable with the escape velocity. The conclusion is made that such high speed of substance molecules is the basis of the nonlinear physical processes to ensure the successful use of unique properties of CNF in novel technologies [6].

### References

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