Dipole glass state parameter in the mixed ferro-antiferroelectric systems

N. Korynevskii[a,b,c] and V. Solovyan[a]

[a] *Institute for Condensed Matter Physics, National Academy of Sciences of Ukraine, 1 Svientsitskii Str., 79011 Lviv, Ukraine, E–mail: koryn@icmp.lviv.ua*

[b] *Lviv Polytechnic National University, 12 S. Bandera Str., 79013 Lviv, Ukraine*

[c] *Institute of Physics, University of Szczecin, 15 Wielkopolska Str., 70451 Szczecin, Poland*

The problem of the dipole glass parameter behaviour in the mixed ferro-antiferroelectric compounds is presented. Our approach is based on the using of single and pair correlation functions of nearest neighbours for determination of this parameter. We will discussed the microscopic origin of dipole glass state, the conditions for existence of pure ferroelectric and antiferroelecrtic phases both the coexistence mixed dipole glass state and a long ordered phases. Among different compounds in which the dipole glass state is observed the ferro-antiferroelectric solid mixtures of $Rb_n(NH_4)_{1-n}H_2AsO_4$ type with hydrogen bonds are presented. In those materials at relatively low temperatures (below 80 K) and for intermediate concentration ($0.50 \leq n \leq 0.80$) due to the interparticle interactions frustration the long range ordering disappears and only the short range correlations between nearest particles remains.

We used the generalized two-particle cluster approximation and the replica method for the free energy of investigated system calculation. On this base the phase diagram of mixed system is built. Its behaviour is in a good coincidence with the experimental date. It is proved that dipole glass state is formed due to non-ergodic distribution of pair correlation functions in the mixed system. It was found ordered ferro- and antiferroelectric phases exist only separately both the possibility of coexistence of dipole glass state with ordered phases. The existence of experimentally observed precursors of the dipole glass state phase (for temperatures above 80 K) was confirmed. They are interpreted as a "slight" dipole glass phase properties of the system with the limit number for the different types of short range nearest neighbours correlations.