Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Dynamics of self-trapped excitons in layered $Pb_{1-X}Cd_XI_2$ semiconductors YURIY GNATENKO, ANATOLII BUKIVSKII, YURIY PIRYATINSKI, Institute of Physics of National Academy of Science of Ukraine — The dynamics of self-trapped excitons, localized on stretched Pb-I chemical bonds which are formed on PbI_2 nanocluster surface was investigated. It should be noted that these nanoclusters are naturally formed in $Pb_{1-X}Cd_XI_2$ (X = 0.5 and X = 0.7) layered semiconductor solid solutions. They have different sizes (from several nm to several tens of nm). The measurements of photoluminescence (PL) spectra and kinetics of PL intensity decay for those materials were performed at T=300 K. The kinetic dependencies were obtained for the maximum of PL band (600 nm) and for its short-wave shoulder (550 nm). It was shown that PL decay kinetics is approximated by Kohlrausch-Williams-Watts (KWW) function, i.e. by stretched exponential function $I(t) = I_0\exp(-(t/\tau_{ef})^{\beta})$. Obtained values of τ_{ef} and β for X = 0.5 are equal about 800 ns and 0.76 at 600 nm. At 550 nm these values are 700 ns and 0.74, respectively. Similarly for X = 0.7 these values correspond about 800 ns and 0.80 at 600 nm. At 550 nm they are 800 ns and 0.82. Application of the Inverse Laplace Transformation (ILT) to our experimental data gave us opportunity to estimate the probability density function of self-trapped exciton state lifetimes for $Pb_{1-X}Cd_XI_2$ (X = 0.3, 0.5 and 0.7). The position of the maximum of $F(\tau)$ gives us the average decay time <t>which is about 1250 ns which significantly differs from τ_{ef} which is about 800 ns (for λ = 550 nm). This complex dynamics of excitons is associated with strong heterogeneity of the investigated system.

Yuriy Gnatenko
Institute of Physics of National Academy of Science of Ukraine

Date submitted: 17 Nov 2014 Electronic form version 1.4