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Emergent structures and dynamics in two-dimensional mixtures

Alokmay Datta
Saha Institute of Nuclear Physics, India

The strong density fluctuations present in lower dimensional systems make two-dimensional structures fundamentally unstable and give rise to distinct long term dynamics at progressively larger length scales. In mixtures this finds expression in emergent two-dimensional patterns created from bi-continuous co-existence of the partially de-mixed components. These patterns can be stabilized or can be made to pass from a periodic (or quasi-periodic) phase to an aperiodic or chaotic phase by tuning suitable 'field' or 'molecular' parameters, thus opening up new areas in the study of self-organization with applications in soft matter science, nanosciene, biophysics, molecular electronics, and nanotechnology. Here we shall be discussing our results pertaining to the above for monomolecular layers of amphiphile-nanoparticle mixtures and drug-lipid mixtures on water surface studied through macroscopic and microscopic techniques on one hand and molecular dynamics simulation on the other. Along with the emergent structures self-organized through de-mixing, we shall also look at some of their mechanical and optical properties.

Biography

Alokmay Datta is a Senior Professor and Head, Surface Physics and Materials Science Division, at Saha Institute of Nuclear Physics. He did his PhD in Physics in 1989 from Calcutta University. Besides being a NSF Postdoctoral Fellow in Northwestern University, USA, he has been a JSPS Visiting Professor in Kyoto University, Japan and a MATISSE Visiting Professor in Université Pierre et Marie Curie, France. He has more than 90 papers in international refereed journals. He is a recipient of Materials Scientist Medal from Materials Research Society of India. His areas of interest are soft materials, nano-soft interfaces and nano-bio interfaces.

alokmay.datta@saha.ac.in

Exciton-like electromagnetic excitation in disordered lattice of coupled microresonators

V V Rumyantsev, S A Fedorov and M V Sychanova
National Academy of Sciences, Ukraine

The physics of photonic super crystals is in many ways similar to the physics of crystalline solids. Due to imperfections of the super crystal lattice photonic gaps may contain impurity states, which are of crucial importance in realistic photonic structures. While the theory of impurity bands and excitons in semiconductor crystals has been developed in 1970-1980s, an analogous theory for photonic crystals is yet to be constructed. In this work we carry out a theoretical study of exciton-like electromagnetic excitations in disordered photonic super crystals composed by coupled micro cavities. We study the propagation peculiarities of these excitations in a two-dimensional non-ideal binary micro-cavity lattice with the use of the virtual crystal approximation. The effect of point defects (vacancies) on the excitation spectrum is being numerically modeled. The adopted approach permits to obtain the dispersion law and the energy gap width of the considered quasiparticles and to analyze the dependence of their density of states on defect concentrations in a micro cavity super crystal. Our study contributes to the modeling of novel functional materials with controllable propagation of electromagnetic excitations.

Biography

V V Rumyantsev is Professor in Nanophysics Department at Donetsk National University (DonNU) and Head of Physics Technology Subdivision at A.A. Galkin Donetsk Institute for Physics and Engineering of NASU (DonPhTI). He received PhD in Physics (1988) from DonNU and Dr. Sci. in Solid State Physics (2007) from DonPhTI. He has published more than 200 scientific publications as an Editorial Board Member of *Advances in Materials* (Science Publishing Group, USA) and *Journal of Lasers, Optics & Photonics* (OMICS Group, USA). He is Group Leader of Int. project in the framework of the European program FP7-PEOPLE-2013-IRSES (2013-2016).

rumyants@teor.fti.ac.donetsk.ua