**Local Sources of Global Order in Regular Structures**

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One of the most fundamental problems of crystallography is the problem of

crystal formation. Since the crystallization is a process which results from mutual

interaction of just nearby atoms, it was believed (L. Pauling, R. Feynmann

et al) that the long-range order of the atomic structure of the resulting crystal comes out certain

local rules restricting the arrangement of nearby atoms. However, before 1970’s there were no

whatever rigorously proved statements about the link between local arrangements of nearby atoms

 and global ordering in a crystallographic structure. In the early 1970’s B. Delone (Delaunay) and R.Galiulin initiated a problem to find such a link and Delone’s students N.Dolbilin and M. Stogrin developed the beginnings of the so-called *local theory of crystals*.

The motivation of the local theory are as follows. An appropriate concept for describing positions of atoms of whatever solid structure (at the zero temperature) is a *Delone set* (or an (*r,R)-system*). However structures with long-range order such that as crystals involve a concept of the *space group* as well. A mathematical model of an *ideal crystalline* matteris defined now as a *Delone set which is invariant with respect to some space* (crystallographic) *group.* Thus, a mathematical model of an ideal crystal uses two concepts: a Delone set (which is *of local character*) and a space group (which is *of global character*).

Meanwhile, as already said, the structure of a crystal is a result of the interaction of the nearby atoms. In this context the main aim of the local theory of a crystal was and is a *rigorous derivation* of global order of a crystalline structure from the pairwise geometric identity of local arrangements of the structure around each its atom.

Mathematically, a *crystal* is defined as a Delone set X which is an orbit of some finite set under some crystallographic group. In the talk it is supposed to expose several basic theorems on how the local identity of a Delone set in the neighborhoods of all its points within certain radius **R** implies that the set is a crystal. There will be introduced all necessary definitions and stated some open questions.