Andrejewski Lecture: Discrete Geometric Analysis

TIME:
11 Nov 2008 - 13 Nov 2008

LOCATION:
Humboldt-Universität zu Berlin
diverse Veranstaltungsorte

PROGRAM:

11 Nov 2008

17:00 **Prof. Dr. Toshikazu Sunada (Meiji University/ Tokyo, Japan)**

Discrete Abel-Jacobi maps and a diamond twin
An Abel-Jacobi map in algebraic graph theory is a canonically defined harmonic function on vertices of a graph with values in a finite abelian
group. This notion is a discrete analogue of Abel-Jacobi maps in algebraic geometry. One may also introduce an analogue of Albanese maps which are canonical harmonic maps of graphs as 1-dimensional cell complexes into flat tori. A discrete version of Abel's theorem tells, as it is the case in algebraic geometry, that these two notions are closely related. Not surprisingly, graph theoretic Albanese maps (and generalizations) turn out to be useful in geometric descriptions of crystals. For an illustration, we will treat the ``diamond twin" which has the same property of symmetry as the diamond crystal and has been pinned down in the study of random walks on crystal lattices.

12 Nov 2008

16:30 **Prof. Dr. Toshikazu Sunada (Meiji University/ Tokyo, Japan)**

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Geometric crystallography
A crystal lattice (topological crystal) is defined to be an nfinite-fold cover over a finite graph. The graph theoretic version of Albanese maps is generalized in order to describe the most standard way to realize crystal lattices in space. We observe that the standard realization is
characterized by a minimizing property of a certain energy functional. It is also pointed out that the standard realization comes up in a long time asymptotic behavior of random walks on a crystal lattice. This is used to show that the standard realization has maximal symmetry.

13 Nov 2008

16:30 **Prof. Dr. Toshikazu Sunada (Meiji University/ Tokyo, Japan)**

Zeta functions for finitely generated groups
This talk discusses spectral properties of ``non-commutative" crystal lattices. After giving a quick survey of twisted Laplacians, we shall take a look at spectral aspects of Cayley graphs associated with finitely generated groups. The notions of cogrowth, zeta functions, and Ramanujan graphs are handled.

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