



Andrejewski-Vorlesung: Discrete Geometric Analysis

ZEIT:

11.11.2008 - 13.11.2008

ORT:

Humboldt-Universität zu Berlin
diverse Veranstaltungsorte

PROGRAMM:**11.11.2008**

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.

12.11.2008

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 n -finite-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.

13.11.2008

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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