Berlin Mathematical School

# BMS Friday Colloquium

## Friday 6 January 2012 at 14:15

*Tea before the lecture begins at 13:00*

BMS Loft, Urania, An der Urania 17, 10787 Berlin


## Gitta Kutyniok

*(TU Berlin)*


## Imaging Science meets Compressed Sensing

Modern imaging data are often composed of several geometrically distinct constituents, for instance, neurobiological images could consist of a superposition of spines (pointlike objects) and dendrites (curvelike objects) of a neuron. A neurobiologist might then seek to extract both components to analyze their structure separately for the study of Alzheimer specific characteristics. However, this task seems impossible, since there are two unknowns for every datum.

Compressed sensing is a novel research area, which was introduced in 2006, and since then has already become a key concept in various areas of applied mathematics, computer science, and electrical engineering. It surprisingly predicts that high-dimensional signals, which allow a sparse representation by a suitable basis or, more generally, a frame, can be recovered from what was previously considered highly incomplete linear measurements by using efficient algorithms.

Utilizing the methodology of Compressed Sensing, the image separation problem can indeed be solved numerically as well as theoretically. For the separation of point- and curvelike objects, we choose a deliberately overcomplete representation system made of wavelets (suited to pointlike structures) and shearlets (suited to curvelike structures). The decomposition principle is to minimize the $\ell_1$ norm of the representation coefficients. This project was done in collaboration with David Donoho and Wang-Q Lim.

In October 2011, Gitta Kutyniok joined the TU Berlin as an Einstein Professor of Mathematics.

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