Speaker: Gitta Kutyniok, Einstein Professor of Mathematics, Institute for Mathematics, Technische Universitat Berlin

Time and Location: Thur. Aug. 22, 2013 at 11am in Weber 223

Title: Optimal Compressive Imaging for Fourier Data

Abstract: One fundamental problem in applied mathematics is the issue of recovery of data from specific samples. Of particular importance is the case of pointwise samples of the associated Fourier transform, which are, for instance, collected in Magnetic Resonance Imaging (MRI). Strategies to reduce the number of samples required for reconstruction with a prescribed accuracy have thus a direct impact on such applications -- which in the case of MRI will shorten the time a patient is forced to lie in the scanner without moving.

In this talk, we will present a sparse subsampling strategy of Fourier samples which can be shown to perform optimally for functions governed by anisotropic features. For this, we will introduce a dualizable shearlet frame for reconstruction, which provides provably optimally sparse approximations of this class of functions -- such cartoon-like images are typically regarded as a suitable model for images, in particular images from MRI. The sampling scheme will be based on compressed sensing ideas combined with a coherence-adaptive sampling density considering the coherence between the Fourier basis and the shearlet frame. We finally prove that this general sampling strategy can sparsely approximate a function of the considered model class from a collection of its Fourier samples with optimal sampling rate. We conclude with some numerical experiments. This is joint work with Wang-Q Lim (TU Berlin).

Bio: Gitta Kutyniok completed her Diploma in Mathematics and Computer Science in 1996 at the Universitat Paderborn in Germany. She received her Ph.D. degree in the area of time-frequency analysis from the same university in 2000. She completed her Habilitation in Mathematics in 2006 and received her venia legendi. In 2007, she was awarded a Heisenberg Fellowship by the DFG-German Research Foundation.

From 2001 to 2008 she held visiting appointments at several US institutions, including Princeton University, Stanford University, Yale University, Georgia Institute of Technology, and Washington University in St. Louis.

After returning to Germany in October 2008, she became a full professor of mathematics at the Universitat Osnabrueck, and headed the Applied Analysis Group. Since October 2011, she has an Einstein Chair at the Technical University of Berlin and is head of the Applied Functional Analysis Group (AFG).

Her research and teaching have been recognized by various awards, including the von Kaven Prize by the German Research Foundation, awards by the University Paderborn and the Justus-Liebig University Giessen for Excellence in Research, as well as the Weierstrass Prize for Outstanding Teaching. She is an Associate Editor and also

Corresponding Editor for several journals in the area of applied mathematics. She is also a board member of the Berlin Mathematical School, a member of the council of the MATHEON "Mathematics for key technologies" in Berlin, and the chair of the GAMM activity group on "Mathematical Signal- and Image Processing".