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Application for a Mini–Workshop
on
WAVELETS AND FRAMES

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Topics of the Workshop

We would like to apply for a **Mini-workshop** on **Wavelets and Frames**. The workshop will include, but is not limited to, the following topics:

- Wavelet sets: implementation and abstract wavelet theory.

- Finite, Fourier, and Gabor frames: sampling and Beurling-Landau theory.

- Spectral-tile duality in wavelet theory, especially tilings of $\mathbb{R}^n$ and the spectral set conjecture.

The workshop will cover both the mathematical aspects of the theory as well as the applications. For example, JPEG 2000 is almost entirely wavelet-based, involving both the algorithmic side and the analytic side of the subject. The algorithms are based on lifting, and the analysis on wavelet estimates in spaces of functions of bounded variation. Each of these core areas connects to both the operator theory and the frame analysis on which the invited participants work.

These topics are closely related, and all of them are part of modern harmonic analysis. They have a long history intertwining pure and applied mathematics, and a strong and fruitful interaction with applied sciences. But the last twenty years have seen an explosive increase in the volume and importance of these topics. At the same time it has become clear that the tools reach from classical abelian harmonic analysis and numerical harmonic analysis to operator theory and abstract harmonic analysis, including representations of the Heisenberg group.

The organizers

Hans G. Feichtinger, Professor
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Palle Jorgensen, Professor
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Dave Larson, Professor
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The qualification of the organizers

The last three of the organizers are members of the research group *Collaborative Research: Focused Research on Wavelets, Frames and Operator Theory* sponsored by the NSF program *Focused Research Groups*. All the members of this group are among the proposed participants. The organizers as well as other members of the group have organized several special session at AMS-meetings, and smaller workshops on topics related to wavelets and frames since the group stated. More information on the aim of the group group as well as

its member can be found at the webpage: http://www.math.uiowa.edu/~jorgen/waveletFRG.html and also as an appendix to this application.

Prof. H. Feichtinger is a international recognized specialists in time-frequency analysis. He is the editor in chief of the *Journal of Fourier Analysis and its Applications*. He is also the group leader of the *Numerical Harmonic Analysis Group* at the Institute of Mathematics, University of Vienna. He has collaborated with several members of the group.

The organizers work in harmonic analysis, wavelets, and operator theory. Some of them are on the editorial board of scientific journals. All of them have given presentations on their work at several national and international meetings. They all have Ph.D. students, and over the years have produced research mathematicians of stature.

Planned invitations

We plan to invite the following mathematicians:

A. Aldroubi (aldroubi@math.vanderbilt.edu, http://www.math.vanderbilt.edu/~aldroubi/)
L. W. Baggett (baggett@euclid.colorado.edu, http://spot.colorado.edu/~baggett/)
J.J. Benedetto (jjb@math.umd.edu, http://www.math.umd.edu/~jjb/)
A. Cohen (cohen@ann.jussieu.fr, http://www.ann.jussieu.fr/~cohen/)
H. Führ (fuehr@gsf.de, http://www.gsf.de/ibb/homepages/fuehr/)
K. Gröchenig (groch@math.uconn.edu, http://www.math.uconn.edu/~groch/)
C. Heil (heil@math.gatech.edu, http://www.math.gatech.edu/people/faculty/heil,christopher.html)
M. Holschneider (hols@ipgp.jussieu.fr, http://www.math.uni-potsdam.de/~hols/)
G. Kutyniok (gittak@uni-paderborn.de, http://www-math.upb.de/~gittak/)
S. Mallat (Stephane.Mallat@polytechnique.fr, http://www.cmap.polytechnique.fr/~mallat/)
Y. Meyer (meyer@cmla.ens-cachan.fr, http://www.cmla.ens-cachan.fr/Utilisateurs/ymeyer/)
M. Unser (michael.unser@epfl.ch, http://microtechnique.epfl.ch/ioa/people_dir/people/munser.html)
Y. Wang (wang@math.gatech.edu, http://www.math.gatech.edu/~wang/)

Dates

We are aware of the fact that it is up to the director and the scientific board of the Oberwolfach Institut to decide up on the available time. But because of the teaching duties of the USA participants, we would prefer to organize our workshop during the summer 2004. But we both the spring 2004 and November 2003 would be acceptable dates for us.

The organization of the Workshop

We plan to focus on *discussion* and *collaboration* between the participants. We will therefore plan two talks in the morning, each 50 min., (9:00-10:00 and 10:00-11:00) and two talks in the afternoon (16:00-17:00 and 17:00-18:00). Those talks should concentrate on the main topics of the workshop. There will be two main types of talks:

- The state of the knowledge and research today

- Necessary tools and open problems.

During the reminding time the participants will be organized into several smaller groups for discussion and collaboration.

Background

Three of the organizers are members of the NSF-sponsored group *Collaborative Research: Focused Research on Wavelets, Frames, and Operator Theory*. The members of this group are drawn from a variety of mathematical fields including classical Fourier analysis, noncommutative harmonic analysis, representation theory, operator algebra, approximation theory, frames, and signal processing. The work of the group is based on the interdisciplinary nature of our research and the importance of scientific communication and discussion across the boundary of narrowly defined subfields of mathematics and mathematical applications in sciences. This group has organized several special sessions at AMS meetings, and also several workshops and smaller meetings. Those activities have mainly been restricted to participants from the USA, but the organizers are aware of the fact that several internationally recognized specialists in this field are located around Universities in Europe. It is our opinion that a mini-workshop in such an excellent scientific environment as Oberwolfach would provide the best possible conditions for our planned discussion and collaboration.

Further Names

We enclose here a longer list of people that are closely related to the topics in our workshop in case there are openings.

K. Urban (Ulm, kurban@mathematik.uni-ulm.de),
The group at the Institute of Biomathematics and Biometry, WG 1: Mathematical Methods in Signal Processing, head, Frank Filbir.
P. Auscher (auscher@u-picardie.fr)
J.P. Antoine
B. Bekka (bekka@poncelet.univ-metz.fr)
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R. Schneider (Chemnitz)
K. Seip
G. Zimmermann (gzim@uni-hohenheim.de) G. Weiss (guido@math.wustl.edu)

Members of the Focused Research Group

FRG member:	Specialties and URL:
Akram Aldroubi (Vanderbilt University):	Wavelets, frames, sampling theory, signal/image processing, biomedicine http://www.math.vanderbilt.edu/~aldroubi/
Lawrence W. Baggett (University of Colorado):	Harmonic analysis, representation theory, wavelets and generalized multiresolution analyses http://spot.colorado.edu/~baggett/
John J. Benedetto (University of Maryland):	Classical harmonic analysis, frames and wavelet theory, sampling theory, speech compression, periodicity detection http://www.math.umd.edu/~jjb/
Christopher E. Heil (Georgia Institute of Technology):	Time-frequency analysis, frames, pseudodifferential operators, MRA multiwavelets http://www.math.gatech.edu/people/faculty/heil,christopher.html
Palle E.T . Jorgensen (University of Iowa):	Operator theory, spectral theory, spectrum-tile duality, qubit algorithms, mathematical physics, symbolic dynamics http://www.math.uiowa.edu/~jorgen/
David R. Larson (Texas A&M University):	Operator algebras, operator theory, wavelets, frames, functional analysis, applied harmonic analysis http://www.math.tamu.edu/~david.larson/
Gestur Ólafsson (Louisiana State University):	Harmonic analysis and representation theory, special functions, orthogonal polynomials http://www.math.lsu.edu/ olafsson/
Yang Wang (Georgia Institute of Technology):	Self-similarity, tiling, fractal geometry, spectral sets, wavelets http://www.math.gatech.edu/~wang/