Schedule

Sunday Aug. 20

9:00 – 9:40	**Plamen Stefanov** (Purdue), Local lens rigidity with incomplete data for a class of non-simple Riemannian manifolds.
9:45 – 10:25	**Lou Fishman** (MDF International), A Hitchhiker's Guide to the Seismic Phase Space and Path Integral Universe.
10:25 – 11:00	⟨⟨ Coffee ⟩⟩
11:00 – 11:40	**John Schotland** (University of Pennsylvania), Optical Tomography with Large Data Sets.
11:45 – 12:25	**Guillaume Bal** (Columbia University), Kinetic models for the reconstruction of buried inclusions.
12:25 – 2:00	⟨⟨ Lunch ⟩⟩
2:00 – 2:40	**Maarten de Hoop** (Purdue), A multi-scale approach to evolution equations with applications in wave-equation imaging and reflection tomography.
2:45 – 3:25	**Allan Greenleaf** (University of Rochester), An FIO calculus for marine seismic imaging.
3:25 – 4:00	⟨⟨ Coffee ⟩⟩
4:00 – 4:40	**Peter Kuchment** (Texas A&M University), Mathematical problems of thermoacoustic tomography.
4:45 – 5:25	**David Finch** (Oregon State University), An inverse problem for the wave equation.

Monday Aug. 21

9:00 – 9:40	**Joyce McLaughlin** (Rensselaer Polytechnic Institute), Arrival Time and Variance Controlled Methods for Tissue Shear Stiffness Recoveries.
9:45 – 10:25	**Bill Rundell** (Texas A&M University), Inverse obstacle problems..
10:25 – 11:00	⟨⟨ Coffee ⟩⟩
11:00 – 11:40	**Gen Nakamura** (Hokkaido University), Inverse bounday value problem for quaslinear wave equations.
11:45 – 12:25	**David Isaacson** (Rensselaer Polytechnic Institute), Electrical Impedance Imaging.
12:25 – 2:00	⟨⟨ Lunch ⟩⟩
2:00 – 2:40	**David Dos Santos Ferreira** (Universite de Paris Nord), Determining a magnetic Schrodinger operator from partial Cauchy data.
2:45 – 3:25	**Mikko Salo** (University of Helsinki), Determining nonsmooth first order terms from partial Cauchy data.
3:25 – 4:00	⟨⟨ Coffee ⟩⟩
4:00 – 4:40	**Jenn-Nan Wang** (National Taiwan University), Reconstruction of embedded objects by spherical type special solutions.
4:45 – 5:25	**Clifford Nolan** (University of Limerick), Enhanced angular resolution from multiply scattered waves.

Tuesday Aug. 22

9:00 – 9:40	**Liliana Borcea** (Computational and Applied Mathematics, Rice University), Adaptive Coherent Interferometric Imaging in Random Media and Optimal Waveform Design.
9:45 – 10:25	**Hyeonbae Kang** (Seoul National University), The Polya-Szego conjecture on the isoperimetric inequalities for the polarization tensor.
10:25 – 11:00	⟨⟨ Coffee ⟩⟩
11:00 – 11:40	**Michael Vogelius** (Rutgers University), Electromagnetic imaging of small inhomogeneities using a broad band of frequencies.
11:45 – 12:25	**Gang Bao** (Math Dept & Michigan Center for Ind. and Appl. Math. Michigan State University), Inverse Scattering Problems for Electromagnetic Wave Propagation.
12:25 –	⟨⟨ No scheduled talks ⟩⟩

Wednesday Aug 23

9:00 – 9:40	**Matti Lassas** (Affiliation: Helsinki University of Technology), Inverse Problems and Index Formulae for Dirac Operators.
9:45 – 10:25	**Andras Vasy** (Stanford University), Diffraction by edges.
10:25 – 11:00	⟨⟨ Coffee ⟩⟩
11:00 – 11:40	**Hongkai Zhao** (University of California, Irvine), A new phase space algorithm for transmission tomography.
11:45 – 12:25	**Victor Isakov** (Wichita State University), Use of several frequencies in inverse scattering: new uniqueness and stability results.
12:25 – 2:00	⟨⟨ Lunch ⟩⟩
2:00 – 2:40	**Peter Monk** (Department of Mathematical Sciences, University of Delaware), Target Identification of Coated Objects.
2:45 – 2:25	**Samuli Siltanen** (Tampere University of Technology), The d-bar reconstruction method for electrical impedance tomography.
2:25 – 4:00	⟨⟨ Coffee ⟩⟩
4:00 – 4:40	**Matt Yedlin** (Department of Electrical and Computer Engineering, University of British Columbia), New Results in Radio Frequency Tomography.
4:45 – 5:25	**Fioralba Calkoni** (University of Delaware), Identification of partially coated anisotropic buried objects using electromagnetic Cauchy data.

Thursday Aug. 24

9:00 – 9:40	**Kim Knudsen** (Aalborg University), The D-bar method for EIT with discontinuous coefficients.
9:45 – 10:25	**Carlos Villegas** (Universidad Nacional Autonoma de Mexico), Asymtotics of cluster of eigenvalues for perturbations of the hydrogen atom Hamiltonian.
10:25 – 11:00	⟨⟨ Coffee ⟩⟩
11:00 – 11:40	**Leo Tzou** (University of Washington), Stability estimates for coefficients of the magnetic Schrödinger equation from full and partial boundary measurements.
11:45 – 12:25	**Gary Margrave** (Dept of Geology and Geophysics, The University of Calgary), Three Approaches to Stable, Explicit Wavefield Extrapolation.

Abstracts

Guillaume Bal

Kinetic models for the reconstruction of buried inclusions

Columbia University

Buried inclusions can be modeled as variations in the constitutive parameters of a radiative transfer equation for the energy density of waves propagating in highly heterogeneous media. In the practically useful regime where the inclusions have a small volume compared to the overall size of the system, we present asymptotic expansions that characterize the influence of the inclusions on available measurements and show how these formulas may be used towards detection and imaging. These asymptotic formulas are also compared with numerical simulations of the wave equation in the time domain and in the frequency domain. The inclusions are modeled as either void areas (where fluctuations are suppressed) or perfectly reflecting objects. This is joint work with Olivier Pinaud and Kui Ren.

Gang Bao

Inverse Scattering Problems for Electromagnetic Wave Propagation

Math Dept & Michigan Center for Ind. and Appl. Math. Michigan State University

Our recent progress in mathematical analysis and computation of time harmonic Maxwell's equations in complicated media will be discussed. For the direct problems, recent regularity results will be introduced. Various types of boundary conditions will be discussed to reduce the scattering problem into a bounded domain. The first convergence analysis of the recent Perfect Matched Layer (PML) approach for Maxwell's equations will be presented. For the inverse medium scattering, a continuation approach based on uncertainty principle will be presented for both multiple and fixed frequency boundary data. Issues on convergence will also be addressed.

Liliana Borcea

Adaptive Coherent Interferometric Imaging in Random Media and Optimal Waveform Design

Computational and Applied Mathematics, Rice University

I will discuss a robust, coherent interferometric approach for imaging of strong reflectors in cluttered media. By clutter we mean small inhomogeneities in the medium, as they arise in applications in Geophysics, foliage penetrating radar, nondestructive evaluation of aging concrete structures, etc. Naturally, the inhomogeneities are not known and they cannot be estimated precisely from the data, so we deal with an uncertainty about the medium which we model as a random process.

Depending on the strength of the inhomogeneities and the distance of propagation, the effect of the clutter on the wave field can be classified as: 1) Weak interaction, in which case there is a lot of coherence in the data and classic imaging (migration) methods work. 2) Significant interaction, in the sense that the traces are "noisy" and classic migration becomes unreliable. There is however some coherence left in the data and the challenge is to be able to extract it from the noisy traces, with some clever processing. 3) Very strong interaction, in which case all coherence is lost and one can only speak of diffusion type imaging, that relies on intensity measurements and not phases.

The coherent interferometric approach discussed in this talk addresses the second case and it can be viewed as a statistically smoothed migration technique that exploits systematically the spatial and temporal coherence in the data to obtain reliable images.

I will describe in some detail the method, its statistical stability and resolution. In particular, I will explain how the suppression of the clutter noise in the data requires a certain type of smoothing that leads to loss in resolution. This can be quantified explicitly in terms of the statistics of the clutter and the optimal amount of smoothing can be determined adaptively, during the image formation process.

Finally, I will describe some recent results on the question of optimal waveform design for imaging with arrays, in both cluttered and smooth (deterministic) media.

Work in collaboration with: George Papanicolaou (Stanford) and Chrysoula Tsogka (U. Chicago)

Fioralba Calkoni

Identification of partially coated anisotropic buried objects using electromagnetic Cauchy data

University of Delaware

We consider the three dimensional electromagnetic inverse scattering problem of determining information about a target buried in a known inhomogeneous medium from a knowledge of the electric and magnetic fields corresponding to time harmonic electric dipoles as incident fields. The scattering object is assumed to be an anisotropic dielectric that is (possibly) partially coated by a thin layer of highly conducting material. The data is measured at a given surface containing the object in its interior. Our concern is to determine the shape of this scattering object and some information on the surface conductivity of the coating without any knowledge of the index of refraction of the inhomogeneity. No a priori assumption is made on the extent of the coating, i.e. the object can be fully coated, partially coated or not coated at all. Our method is based on the linear sampling method and reciprocity gap functional for reconstructing the shape of the scattering object.

The algorithm consists in solving a set of linear integral equations of the first kind for several sampling points and three linearly independent polarizations. The solution of these integral equations is also used to determine the surface conductivity. This is a joint work with Houssem Haddar.

David Dos santos Ferreira

Determining a magnetic Schrodinger operator from partial Cauchy data

Universite de Paris Nord

In this joint work with Kenig, Sjoestrand and Uhlmann, we show in dimension larger than 2, that measuring the Dirichlet to Neumann map associated to a Schrodinger equation with magnetic and electric potentials on possibly very small subsets of the boundary suffices to determine the magnetic field and the electric potential.

David Finch

An inverse problem for the wave equation

Oregon State University

The measured data in the idealized model of thermoacoustic tomography is the trace on (a subset of) the boundary of a domain over some time interval of the solution of the wave equation with initial data supported in the domain. The inverse problem is to recover the initial data. This talk will present recent work (joint with Rakesh) on range characterization and some initial work on a model allowing detectors with anisotropic response.

Lou Fishman

A Hitchhiker's Guide to the Seismic Phase Space and Path Integral Universe

MDF International

Seismic depth migration imaging attempts to produce an "image" of the earth's substructure from reflection data collected at the surface. However, seismic wave propagation modeling and imaging are complicated by the large-scale and rapidly-varying environments encountered in the earth, and, further, often by the relatively low experimental frequencies employed. Often, in these situations, Kirchhoff (ray-theory-based) methods will not be capable of producing accurate, high resolution images. This recognition led to the development of wave field extrapolation depth migration (WFEDM) methods, which incorporate the full-wave nature of the model, and are based on an (approximate) imaging condition and a wave field extrapolator (propagator). These wave field extrapolators can be modeled and computed with computational partial differential equation (pde) methods or approximate analytical wave field models. The Generalized Phase Shift Plus Interpolation (GPSPI) wave field extrapolator represents an example of the latter approach, and many other wave equation migration imaging models are actually just approximations to this model. The GPSPI approximation is nothing more than the locally homogeneous medium approximation to the exact wave field extrapolator in the frequency domain. Within the seismic community, there are several important misconceptions about the approximate nature and characterization of the GPSPI algorithm. Understanding these misconceptions sets the stage and provides the motivation for the introduction of a mathematical physics framework for WFEDM based on what is loosely referred to as "phase space and path integral methods."

Welcome to my world! These methods were originally developed in the quantum physics and theoretical pde communities, and include the phase space path integral constructions for general, one-way Schrödinger equations, and the theories of pseudodifferential (ΨDO) and Fourier integral (FIO) operators, for example. For fixed-frequency modeling, the primary aims of this approach are (1) to incorporate well-posed, one-way methods into the inherently two-way global formulations, (2) to exploit the correspondences between the classical wave propagation problem, quantum physics, and modern mathematical asymptotics (microlocal analysis), and (3) to effectively extend Fourier-analysis-based constructions to inhomogeneous environments.

This talk will briefly illustrate how the explicit, exact, well-posed, one-way reformulation of "elliptic wave propagation" problems (e.g., the scalar Helmholtz equation) in phase space provides a detailed mathematical framework for WFEDM, both unifying the diverse approximations (e.g., wide-angle parabolic modeling, generalized phase screens, GPSPI), and systematically extending the physically based GPSPI algorithm. The extensions of GPSPI are at the levels of both decoupled and coupled wave field extrapolation in the background medium, with the basic GPSPI marching algorithm preserved in each case. Moreover, the one-way reformulation in phase space provides exact imaging conditions relating (1) the up- and down-going wave field components and (2) the total wave field and its normal derivative at an arbitrary level in the subsurface. This, subsequently, results in a direct (non-optimization-based), non-perturbative, one-way marching, inversion algorithm for the complete velocity field, accounting, in principle, for all of the multiple scattering.

Alan Greenleaf

An FIO calculus for marine seismic imaging

University of Rochester

We consider a linearization of the inverse problem of determining the sound speed in the interior of the Earth from boundary measurements corresponding to seismic experiments. Nolan and Symes showed, among other things, that for the marine data acquisition geometry, the operator, F, taking singular perturbations of a smooth background sound speed to perturbations of the pressure field is a Fourier integral operator. We are interested in understanding the resulting normal operator, F^*F, in the presence of fold caustics. We are able to describe the geometry of the underlying canonical relation and develop an FIO calculus suitable for finding the normal operator. In contrast to the single source geometry, studied by Nolan and by Felea, where the caustics produce artifacts as strong as the genuine image, here the artifacts are 1/2 derivative smoother. (Joint work with Raluca Felea.)

Maarten de Hoop

A multi-scale approach to evolution equations with applications in wave-equation imaging and reflection tomography

Purdue

Downward continuation based imaging and reflection tomography can essentially be expressed in terms of solving particular evolution equations. The underlying model describes the single scattering of waves in a background medium. Here, we are concerned with developing a method that admits background media of limited smoothness, which leads to evolution equations generated by certain paradifferential operators. We follow a multi-scale approach derived from the approach of H. Smith (1998) to solving such evolution equations, and make use of solution representations based on wavepackets or the frame of curvelets and their interaction. We discuss results concerning the ‘concentration’ of curvelets. We also discuss computational aspects of the method that lead us to deviate from the use of a frame.

Joint research with H. Smith, G. Uhlmann, F. Andersson and R.D. van der Hilst.

David Isaacson

Electrical Impedance Imaging

Rensselaer Polytechnic Institute

Electrical impedance imaging systems apply currents to electrodes on part of the surface of a body. They measure the resulting voltages. Images of approximations to the electrical conductivity and permittivity inside the body are reconstructed and displayed from this electrical data. Since hearts filled with blood, lungs depleted of air, and breast tumors, have significantly higher conductivity and permittivity than hearts depleted of blood, lungs filled with air, and normal breast tissue impedance images may show cardiac and lung function as well as the presence of breast cancer. Mathematical problems arising in the design, construction, and testing of systems for monitoring heart and lung function as well as breast cancer diagnosis will be discussed. A description of the ACT4 imaging system as well as images made by this system will be given. Problems that we are facing in imaging and diagnosing breast cancer patients will be discussed.

Joint work with J. Newell, G. Saulnier

Victor Isakov

Use of several frequencies in inverse scattering: new uniqueness and stability results

Wichita State University

We show that boundary or scattering data for wave (Helmholtz) equation at fixed incident direction fixed time interval (many frequencies) uniquely determine scatterer and a impedance type boundary condition. Proofs use Carleman estimates and analyticity of scattering pattern from special data. We show increased stability of continuation from far field to near field when frequency is increasing and increased stability in the inverse medium problem.

Hyeonbae Kang

The Polya-Szego conjecture on the isoperimetric inequalities for the polarization tensor

Seoul National University

To each inclusion associated a matrix called the polarization tensor. It determines the dipole expansions of the perturbation of the field due to the presence of the inclusion. The concept of the polarization tensor appears naturally in various field of mathematics and solid mechanics-effective medium theory and invesre problems to name only two. In this talk we will prove the Polya-Szego conjecture which asserts that the domain whose polarization tensor has the minimal trace is a disk or a ball. We will also discuss a related conjecture-Eshelby's conjecture. This talk is based on joint works with Graeme W. Milton and Eunjoo Kim.

Kim Knudsen

The D-bar method for EIT with discontinuous coefficients

Aalborg University

In this talk I will discuss the reconstruction issue of the inverse conductivity problem in two dimensions. This is a fundamental mathematical problem in Electrical Impedance Tomography. Reconstruction algorithms for sufficiently regular conductivities based on the D-bar method have been known and studied for a while, and I will discuss how these methods, can also be applied in the case of discontinuous conductivities by using certain approximations. The resulting algorithm can then be seen as a hybrid between Caldern's linearization method and an exact reconstruction method. Theoretical properties of the method will be discussed and numerical examples will be provided.

This work is joint with Matti Lassas, Jennifer Mueller and Samuli Siltanen.

Peter Kuchment

Mathematical problems of thermoacoustic tomography

Texas A&M University

This survey talk will be devoted to discussion of exciting mathematical problems arising in the so called Thermoacoustic Tomography. The topics to be addressed will include uniqueness of inversion, inversion formulas, incomplete data problems, and range conditions. Progress in all of these has been very recent, and all of them are still not completely resolved.

Matti Lassas

Inverse Problems and Index Formulae for Dirac Operators

Affiliation: Helsinki University of Technology

We consider a selfadjoint Dirac-type operator D_P on a vector bundle V over a compact Riemannian manifold (M, g) with a nonempty boundary. The operator D_P is specified by a boundary condition $P(u|_{\partial M}) = 0$ where P is a projector which may be a non-local, i.e. a pseudodifferential operator. We assume the existence of a chirality operator which decomposes $L^2(M, V)$ into two orthogonal subspaces $X_+ \oplus X_-$. In the talk we consider the reconstruction of (M, g), V, and D_P from the boundary data on ∂M. The data used is either the Cauchy data, i.e. the restrictions to $\partial M \times R_+$ of the solutions to the hyperbolic Dirac equation, or the boundary spectral data, i.e. the set of the eigenvalues and the boundary values of the eigenfunctions of D_P. We obtain formulae for the index and prove uniqueness results for the inverse boundary value problems. We apply the obtained results to the classical Dirac-type operator in $M \times \mathbb{C}^4$, $M \subset \mathbb{R}^3$.

Gary Margrave

Three Approaches to Stable, Explicit Wavefield Extrapolation

Dept of Geology and Geophysics, The University of Calgary

Wavefield extrapolation through highly heterogeneous media has an approximate formulation as a Fourier integral operator. Direct numerical calculation of this operator can lead to very accurate seismic images but the computational load is not practical. I will present three alternatives to practical computation for large datasets. In the first and second approaches, the FIO is converted to an equivalent pseudodifferential operator whose kernel lacks compact support. Rapid computation arises from finding a compactly supported approximate kernel. However, simple windowing leads to a numerically unstable wavefield marching scheme. In the first approach, stability is approached by formulating a Wiener filter problem whose solution gives a stabilizing secondary "helper" operator. In the second approach, a WKBJ approximation to an artificial local velocity gradient is used to gain practical stability. Finally, in the third approach, a Gabor approximation to the original FIO is used. All three methods lead to useful imaging algorithms but with differing properties and potential.

Joint work with Saleh Al-Saleh, Chad Hogan and Yongwang Ma

Joyce McLaughlin

Arrival Time and Variance Controlled Methods for Tissue Shear Stiffness Recoveries

Rensselaer Polytechnic Institute

We define, and establish Lipschitz Continuity, for arrival times for anisotropic acoustic wave propagation (joint work with Jeong-Rock Yoon). We implement viscoelasticity in arrival time identification and show significant improvement in supersonic imaging and transient elastography shear stiffness recovery. We establish a variance controlled algorithm for recovery of shear stiffness in MR Elastography.

Peter Monk

Target Identification of Coated Objects

Department of Mathematical Sciences, University of Delaware

We consider the three dimensional electromagnetic inverse scattering problem of determining information about a coated object from a knowledge of the electric far field patterns corresponding to time harmonic incident plane waves at fixed frequency. We assume that the obstacle is either a perfect conductor coated by a thin dielectric layer or a dielectric coated by a thin layer of a highly conducting material, i.e. the the coated portion of the boundary is modeled by either an impedance boundary condition or a conductive boundary condition. No a priori assumption is made on the connectivity of the scattering obstacle nor on the extent of the coating, i.e. the object can be either fully coated,partially coated or not coated at all. We present an algorithm based on the linear sampling method for reconstructing the shape of the scattering obstacle together with an estimate of either the surface impedance or surface conductivity. Numerical examples are given showing the efficaciousness of our method.

Joint work with D.L. Colton.

Gen Nakamura

Inverse bounday value problem for quaslinear wave equations

Hokkaido University

We define the hyperbolic Dirichlet to Neumann map for small Dirichlet datal and discuss about identifying the Taylor coefficients of the nolinear terms. This inverse problem arises from identifying the physical property of the piezoelectric transducer.

Clifford Nolan

Enhanced angular resolution from multiply scattered waves

University of Limerick

Multiply scattered waves are often neglected in imaging methods; largely because of the inability of standard algorithms to deal with the associated non-linear models. This talk shows that by incorporating a known environment into the background model, we can not only retain the benefits of imaging techniques based on linear models, but also obtain different views of the target scatterer. The net result is an enhanced angular resolution of the target to be imaged.

William Rundell

Inverse obstacle problems.

Texas A&M University

This talk looks at several methods for the reconstruction of interior obstacles from boundary measurements. Specifically, we consider the problem to be modelled by Laplace's equation and the boundary data to consist of Cauchy data measured on the outer boundary, but considerably less than the full Dirichlet to Neumann map.

Mikko Salo

Determining nonsmooth first order terms from partial Cauchy data

University of Helsinki

We extend recent work of Dos Santos Ferreira, Kenig, Sjöstrand, and Uhlmann, and show that measurements on small subsets of the boundary uniquely determine the magnetic field and electric potential of a Schrödinger operator, in case the magnetic potential is Hölder continuous. The earlier result assumed a C^2 magnetic potential.

The argument is based on Carleman estimates, a smoothing procedure, and the construction of special solutions to the Schrödinger equation. However, with less regular coefficients we need to combine Carleman estimates with the pseudodifferential conjugation method due to Nakamura and Uhlmann. An important part of the work is to establish the conjugation method for logarithmic Carleman weights. This is joint work with Kim Knudsen from Aalborg University.

John C Schotland

Optical Tomography with Large Data Sets

University of Pennsylvania

In this talk we review recent progress on the development of fast image reconstruction algorithms for optical tomography. These algorithms derive from an analysis of the inverse scattering problem for the radiative transport equation within the diffusion approximation and are applicable to data sets as large as 10^{10} measurements. Data sets of this size have the potential to significantly improve the quality of reconstructed images in optical tomography. Numerical simulations and experimental data from model systems are used to illustrate the results.

Samuli Siltanen

The d-bar reconstruction method for electrical impedance tomography

Tampere University of Technology

In electrical impedance tomography (EIT) one applies a set of electric voltage distributions at the boundary of an unknown physical body, measures the resulting currents through the boundary and reconstructs electric conductivity inside the body. A regularized reconstruction method for two-dimensional EIT is presented and applied to measured data. The algorithm is based on the d-bar method first introduced for 2D EIT by A. Nachman.

Plamen Stefanov

Local lens rigidity with incomplete data for a class of non-simple Riemannian manifolds

Purdue

Let σ be the scattering relation on a compact Riemannian manifold M with non-necessarily convex boundary, that maps initial points of geodesic rays on the boundary and initial directions to the outgoing point on the boundary and the outgoing direction. Let ℓ be the length of that geodesic ray. We study the question of whether the metric g is uniquely determined, up to an isometry, by knowledge of σ and ℓ restricted on some subset D. We allow possible conjugate points but we assume that the conormal bundle of the geodesics issued from D covers T^*M; and that those geodesics satisfy a certain non-conjugacy assumption. Under an additional topological assumption, we prove that σ and ℓ restricted to D uniquely recover an isometric copy of g locally near generic metrics, and in particular, near real analytic ones.

Leo Tzou

Stability estimates for coefficients of the magnetic Schrödinger equation from full and partial boundary measurements

University of Washington

Stability Estimates for Coefficients of Magnetic Schrödinger Equation From Full and Partial Boundary Measurements In this talk we discuss a log-log-type estimate which shows that in dimension three or higher the magnetic field and the electric potential of the magnetic Schrodinger equation depends stably on the Dirichlet to Neumann (DN) map even when the boundary measurement is taken only on a subset that is slightly larger than half of the boundary. Furthermore, we prove that in the case when the measurement is taken on all of the boundary one can establish a better estimate that is of log-type. The proofs involve the use of the complex geometric optics (CGO) solutions of the magnetic Schrodinger equation constructed by G. Nakamura, Z. Sun, and G. Uhlmann. We then use these solutions as in G. Alessandrini to establish the desired stability estimate.

In the partial data estimate we follow the general strategy of H. Heck and J. Wang by using a Carleman-type estimate applied to a continuous dependence result for analytic continuation developed by G. Vessella.

Andras Vasy

Diffraction by edges

Stanford University

I will discuss the propagation of singularities for the wave equation on manifolds with corners, with special attention paid to the issue whether some part of the reflected waves is weaker than the incoming wave (in terms of Sobolev regularity). This is joint work with Richard Melrose and Jared Wunsch.

Carlos Villegas

Asymtotics of cluster of eigenvalues for perturbations of the hydrogen atom Hamiltonian

Universidad Nacional Autonoma de Mexico

We present in this talk a limiting eigenvalue distribution theorem for the Schrdinuer operator of the hydrogen atom (with the Planck parameter $\hbar$ included) plus ϵ times a bounded continuous function Q. By considering suitable dilation operators , we prove that taking $\epsilon = O(\hbar^2)$ we obtain well defined clusters of eigenvalues around the energy $E = -1/2$ whose limiting distribution involves the Radon transform of the function Q along the classical orbits of the Kepler problem with energy $E = -1/2$ with respect to an integration over the space of geodesics of the 3-sphere S^3. The idea of the proof involves a well known unitary transformation from the Hilbert space generated by the bound states of the hydrogen atom onto $L^2(S^3)$ and coherent states on the sphere S^3. We will comment on the generalization of the theorem above to the n-dimensional case and when Q is a pseudodifferential operator of order zero.

Michael Vogelius

Electromagnetic imaging of small inhomogeneities using a broad band of frequencies

Rutgers University

I shall discuss some recent results, describing the electromagnetic field perturbations caused by the presence of small inhomogeneities. Special emphasis will be placed on the dependence of the perturbations on the frequency of the “incident” (or background) field.

Jenn-Nan Wang

Reconstruction of embedded objects by spherical type special solutions

National Taiwan University

In this talk I would like to discuss the reconstruction of embedded objects by special type of complex geometrical optics solutions called complex spherical waves. The real part of the phase function for complex spherical waves is a radial function. That is, its level surfaces are spheres. I will talk about how to construct these special solutions for isotropic elasticity and the reconstruction of inclusions in this setting. Furthermore, to show the true merits of complex spherical waves, I will also discuss the inverse problem in an infinite slab.

Matt Yedlin

New Results in Radio Frequency Tomography

Department of Electrical and Computer Engineering, University of British Columbia

Tomography provides us a means of obtaining an interior property image of a closed object through measurements of scattered data, given a known source. This presentation will begin with a short motivation for the use of radio frequency tomography, including a brief summary of the methodology including antenna deployment and antenna characteristics. Then a canonical two-dimensional scattering problem of an incident monochromatic plane wave on an infinite homogeneous dielectric cylinder will be defined and new results related to the asymptotics of near-field scattering will be presented. In addition the concept of fuzzy non-uniqueness will be introduced. Finally, an initial set of L^2 inversion results will be presented, incorporating model smoothness constraints, in a multifrequency setting.

Hongkai Zhao

A new phase space algorithm for transmission tomography

University of California, Irvine

A new algorithm based on a phase space formulation for recovering Riemannian metrics in a domain from boundary measurements is developed. In particular this formulation can deal with anisotropic media. We will discuss the formulation, algorithm and numerical results in this talk. This is a joint work with E. Chung, J. Qian, and G. Uhlmann.
