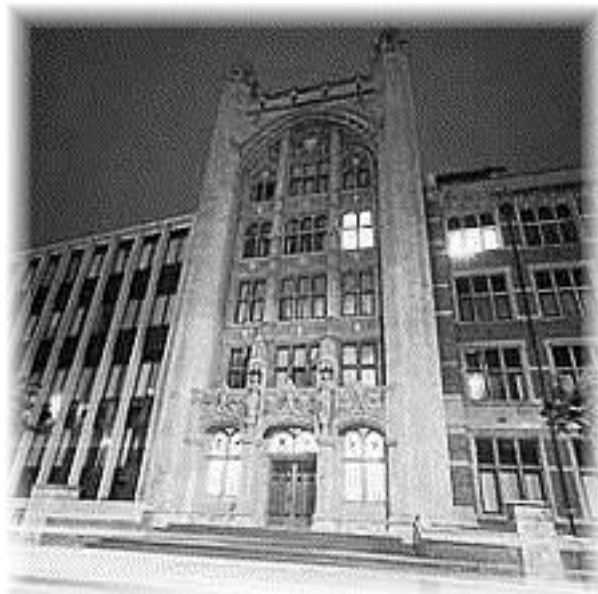


EPSRC Spectral Theory Network Conference V

Cardiff University, 15-17 December 2003



Cardiff School of Computer Science
Queen's Buildings, The Parade, Cardiff, CF14 9HP

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TIMETABLE OF TALKS AND EVENTS

Talks are in Trevithick Building, Room T/2.07. Coffee and meals are in Trevithick Seminar Rooms 1 and 2. There will be a small exhibition of posters in Seminar Room 1 from Monday afternoon.

Time	Monday	Tuesday	Wednesday
9:25am	Announcements		
9:30am	Chair: W D Evans	Chair: M S P Eastham	Chair: P K Jimack
	Resonances of the Hain-Lüst operator M Marletta	Open problems in the spectral theory of Toeplitz operators E Shargorodsky	Spectral stability of the Robin Laplacian V I Burenkov
10:30am	Coffee	Coffee	Coffee
11:00am - 12:00pm	Variational approaches to the linear Dirac equation E Sere	Bethe-Sommerfeld conjecture L Parnovski	An extension of the Weyl limit point / limit circle theory to differential operators in 3 space dimensions D B Pearson
12:15pm	Lunch	Lunch	Lunch
2:30pm		Chair: E B Davies	End of Meeting
		On the Discrete Spectrum of a Pseudo-Relativistic Two-Body Pair Operator T Weidl	
3:30pm	Coffee	Coffee	
4:00pm	Chair: B M Brown	A global Lipschitz continuity result for a domain dependent Neumann eigenvalue problem for the Laplacian P D Lamberti	
	Decay bounds in a model for aggregation of microglia: application to Alzheimer's disease senile plaques B Straughan		
5:00pm - 6:00pm	A variational approach to the seismic inverse problem M Jais	Variations on the trapped modes theme M Levitin	
6:30pm	Buffet Dinner		
7:00pm		Dinner	

ABSTRACTS

RESONANCES OF THE HAIN-LÜST OPERATOR

M MARLETTA
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We consider both the local and the global behaviour of resonances of the one-dimensional Hain-Lüst operator as functions of a 'coupling' parameter.

VARIATIONAL APPROACHES TO THE LINEAR DIRAC EQUATION

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Several variational characterizations of the eigenvalues of Dirac operators with potential will be presented: min-max, minimisation under constraints. A variational approach related to QED will also be presented.

DECAY BOUNDS IN A MODEL FOR AGGREGATION OF MICROGLIA: APPLICATION TO ALZHEIMER'S DISEASE SENILE PLAQUES

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Chemotactic cells known as microglia are involved in the inflammation associated with pathology in Alzheimer's disease. We study a mathematical model which allows for conditions which lead to aggregation of microglia and formation of local

accumulations of chemicals as observed in Alzheimer's disease senile plaques. A nonlinear analysis is given for the model and conditions are derived such that aggregation cannot occur. The analysis involves energy like estimates for suitable Lyapunov functions and use of appropriate Sobolev inequalities to control the nonlinearities.

A VARIATIONAL APPROACH TO THE SEISMIC INVERSE PROBLEM

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A variational approach to the seismic inverse problem of determining the coefficients C and ρ of the hyperbolic system of partial differential equations

$$\sum_{j,k,l} \frac{\partial}{\partial x_j} (C_{i,j,k,l}(x) \frac{\partial}{\partial x_l} u_k(x,t)) + f_i(x,t) = \rho(x) \frac{\partial^2}{\partial t^2} u_i, \quad 1 \leq i \leq n,$$

from traction and displacement data measured on the surface, will be presented. A crucial point of the approach will be a transformation of the above system to an elliptic system of partial differential equations

$$-\sum_k \nabla \cdot (C_{i,k} \nabla \hat{u}(x,s)_k) + \rho s^2 \hat{u}(x,s)_i = \hat{f}(x,s)_i - l(x,s)_i, \quad 1 \leq i \leq n.$$

Thus the inverse problem for a hyperbolic system is transformed to an inverse problem for an elliptic system plus an additional inverse source problem of recovering the term l in the above elliptic equation. Theoretical results needed for a successful recovery procedure of the coefficients C and ρ will be developed and various numerical results, that show the effectiveness of the approach, presented.

OPEN PROBLEMS IN THE SPECTRAL THEORY OF TOEPLITZ OPERATORS

E SHARGORODSKY
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The talk will give a review of known results and open problems concerning essential spectra of Toeplitz operators with bounded measurable coefficients.

SPECTRAL STABILITY OF THE ROBIN LAPLACIAN

V I BURENKOV
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We consider the Robin Laplacian in two bounded regions Ω_1 and Ω_2 of \mathbb{R}^N with Lipschitz boundaries, and such that $\Omega_2 \subset \Omega_1$, and we obtain two sided estimates for the eigenvalues $\lambda_{n,2}$ of the Robin Laplacian in Ω_2 via the eigenvalues $\lambda_{n,1}$ of the Robin Laplacian in Ω_1 . Our estimates depend on the measure of the set difference $\Omega_1 \setminus \Omega_2$, and on suitably defined characteristics of vicinity of the boundaries $\partial\Omega_1$ and $\partial\Omega_2$, and of the functions defined on $\partial\Omega_1$ and on $\partial\Omega_2$ which enter the Robin boundary conditions.

ON THE DISCRETE SPECTRUM OF A PSEUDO-RELATIVISTIC TWO-BODY PAIR OPERATOR

T WEIDL

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The Herbst operator $\sqrt{-\Delta + 1} - V$ is often used in pseudo-relativistic quantum mechanics. We show, that one should be careful when applying this model. In particular, the number of bound states of the two-body pair Herbst operator depends on the relative velocity of the system with respect to the observer.

We prove Cwikel-Lieb-Rosenbljum and Lieb-Thirring type bounds on the discrete spectrum and calculate spectral asymptotics for the eigenvalue moments and the local spectral density in the pseudo-relativistic limit.

This is a joint work with S Wugalter.

A GLOBAL LIPSCHITZ CONTINUITY RESULT FOR A DOMAIN DEPENDENT NEUMANN EIGENVALUE PROBLEM FOR THE LAPLACIAN

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Let Ω be an open connected subset of \mathbb{R}^n of finite measure for which the Sobolev space $W^{1,2}(\Omega)$ is compactly imbedded in $L^2(\Omega)$.

We consider the Laplace operator $-\Delta$ with Neumann boundary conditions in a class of domains $\phi(\Omega)$ parametrized by suitable homeomorphisms ϕ of Ω onto $\phi(\Omega)$. Then we present a Lipschitz continuity result for the dependence of the eigenvalues and eigenvectors of $-\Delta$ upon variation of ϕ .

VARIATIONS ON THE TRAPPED MODES THEME

M LEVITIN

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We consider several problems arising in the theory of water waves. The general question discussed is the existence of eigenvalues in the presence of an essential spectrum, and their localization.

BETHE-SOMMERFELD CONJECTURE

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The proof of the Bethe-Sommerfeld conjecture will be presented. The conjecture states that Schrödinger operator with periodic potential cannot have infinitely many gaps in the spectrum in dimensions greater than 1.

AN EXTENSION OF THE WEYL LIMIT POINT / LIMIT CIRCLE THEORY TO DIFFERENTIAL OPERATORS IN 3 SPACE DIMENSIONS

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The Weyl theory of the m -function for ordinary differential (Schrödinger) operators may be generalised and applied to partial differential operators in 3 space dimensions. Analogues are found of Weyl circles, and are shown to share a number of the properties which hold in the theory for ode's.

This work is joint with Werner Amrein (University of Geneva).

NEXT MEETING

The Spectral Theory Network Conference VI will be a three day meeting at Cardiff University from the 23rd to the 25th of July 2004. It will also mark the 60th birthday of Professor E B Davies FRS (King's London).

Further details can be found at <http://www.cs.cf.ac.uk/STNetwork/conf0704.html>.