

# SEMINARIO DE OPERADORES Y FÍSICA-MATEMÁTICA

Organizers: *Doctors: Rafael del Río, Luis O. Silva y Ricardo Weder*

## INVERSE RESONANCE PROBLEM FO THE SCHRÖDINGER OPERATOR ON THE HALF-LINE

**Prof. Roman Shterenberg**

Departamento de Matemáticas  
Universidad de Alabama

### Abstract

We consider Schrödinger operators on  $[0, \infty)$  with compactly supported, possibly complex-valued potentials in  $L^1([0, \infty))$ . It is known (at least in the case of a real-valued potential) that the location of eigenvalues and resonances determines the potential uniquely. From the physical point of view one expects that large resonances are increasingly insignificant for the reconstruction of the potential from the data. In this paper we prove the validity of this statement, i.e., we show conditional stability for finite data. As a by-product we also obtain a uniqueness result for the inverse resonance problem for complex-valued potentials.

Based on the joint paper with M. Marletta and R. Weikard.

*23 y 24 de noviembre de 2011*



## THE DYNAMICS OF QUASI-PERIODIC JACOBI COCYCLES

**Dr. Chris Marx**

Universidad de California, Irvine

### Abstract

Recently, several problems from the spectral theory of 1 dimensional quasi-periodic Jacobi operators could be successfully solved studying the dynamics of associated cocycles. Even though some of these ideas are well known in dynamical systems, they are still less common in the spectral theory community. In this talk, we aim to bridge the gap, presenting a survey of the dynamics of cocycles from a spectral theorists point of view.

Topics that will be discussed include:

Singular quasi-periodic Jacobi cocycles, Lyapunov exponent (LE) and Oseledets' theorem, Conjugacies - Aubry duality revisited, (almost) reducibility and the absolutely continuous spectrum, uniform hyperbolicity, LE of singular analytic cocycles - continuity and method of computation, complexified LE and the spectrum

Our recent work on Extended Harper's Model, a generalization of almost Mathieu, will serve as an illustration for many of the presented methods.

*30 de agosto y 1 de septiembre de 2011*



## **CAVITIES AND POINT-LIKE SYSTEMS FOR RELATIVISTIC QUANTUM INFORMATION PROCESSING**

**Dra. Ivette Fuentes-Schuller**

School of Mathematical Sciences  
University of Nottingham, Uk.

### **Abstract**

In the emerging field of relativistic quantum information, space-time and relativistic effects are incorporated into the question of how to process information using quantum systems. The fact that nature is both quantum and relativistic, and that most realistic implementations of quantum information involve relativistic systems, has motivated the development of this research field. A first step to be taken is to find suitable ways to store information in a quantum field theoretical framework. In this talk I will show how cavities and point-like systems can be used for this purpose.

*25 de agosto de 2011*



## **HOMOGENISATION AND SPECTRAL ANALYSIS OF DO'S: AN INTRODUCTION**

**Dr. Kirill Cherednichenko**

School of Mathematics  
Cardiff University, UK.

### **Abstract**

I will give an outline of the area of averaging (or “homogenisation”) of linear elliptic differential operators. In the context of spectral theory, it concerns the asymptotic behavior of the spectra of operator families whose properties oscillate on a small scale  $\varepsilon$ , so that  $\varepsilon \rightarrow 0$  in the limit. I will then discuss a class of homogenisation problems whose spectra are guaranteed to have a band-gap structure as  $\varepsilon \rightarrow 0$ .

*11 de agosto de 2011*



## **MINI-CURSO: SPECTRAL THEORY OF CANONICAL SYSTEMS AND DE BRANGES SPACES**

**Dr. Roman V. Romanov**

Instituto de Física, Laboratorio de Redes Cuánticas  
Universidad Estatal de San Petersburgo, Rusia

### **Abstract**

We describe an approach to direct and inverse spectral theory for ordinary differential operators based on the notion of canonical system which allows to unify the treatment of Schrödinger, Dirac and string operators and Jacobi matrices. The inverse theory for canonical systems is based on structural properties

of de Branges spaces and is related to problems in the classical theory of functions such as interpolation, growth of entire functions, polynomial approximations and decompositions in continuous fractions.

*13, 17 y 19 de enero de 2011*



## **MINI-CURSO: ORTHOGONAL POLYNOMIALS ON THE UNIT CIRCLE, CMV MATRICES, AND THE DISTRIBUTION OF THEIR EIGENVALUES**

**Dr. Mihai Stoiciu**

Departamento de Matemáticas y Estadística

Colegio Williams

### **Abstract**

We will start with a brief introduction to the theory of orthogonal polynomials on the unit circle (OPUC) and the associated CMV matrices. From the point of view of orthogonal polynomials, the CMV matrices are unitary analogues of the Jacobi matrices. We consider various classes of random and deterministic CMV matrices and study the distribution of their eigenvalues. More precisely, we consider CMV matrices with random decaying coefficients and CMV matrices associated to hyperbolic reflection groups. We show that, as the spectral measures approach an absolutely continuous measure, the repulsion between the eigenvalues increases and the eigenvalue distribution converges to the “clock” (or “picket fence”) distribution.

*12, 14 y 18 de enero de 2011*