M3 What Do the Boundaries Tell Us?

Organiser: Teemu Saksala, *University of Helsinki*

1. Asymptotic Dirichlet Problem for the Minimal Graph Equation

Esko Heinonen, *University of Helsinki*

I will discuss about the asymptotic Dirichlet problem for the minimal graph equation on Cartan-Hadamard manifolds. The existence of solutions depends on the curvature so we will consider manifolds whose sectional curvatures are bounded from above and below by certain functions or satisfies certain pointwise pinching condition.

2. Inverse boundary value problem for the wave equation

Lauri Oksanen, *University College London*

We review some results related to the inverse boundary value problem for the wave equation. This problem can be seen for example as a highly idealized model for seismic imaging, where the ground motion is recorded at several measuring locations as a function of time, and we want to reconstruct the spatially varying material parameters inside the Earth. In the case of the acoustic wave equation, the material parameter to be reconstructed corresponds to the speed of sound.

3. Seeing inside the Earth. Riemannian manifolds with boundary and distance function.

Teemu Saksala, *University of Helsinki*

In this talk we start with the basics of Riemannian manifolds with boundary. They we will serve us as a mathematical model with which we can describe many interesting problems in geometrical inverse problems. For instance one can consider a geophysical problem of determining the structure of the Earth from earthquakes. Here the surface of the Earth is the boundary and the Riemannian metric holds information about the structure of soil underneath it. An earthquake generates waves that propagate through Earth. The information about Riemannian metric helps us to understand how these waves behave. Where dothey go and with which velocity.

We will define the Riemannian distance functions. Our goal is to show, how only knowing the restrictions of these functions to the boundary, we can find lot's of information about the mathematical structure of manifold. We will use the book: Inverse boundary spectral problems, 2001 by A. Katchalov, Y. Kurylev, M. Lassas as our main reference.

4. Inverse problems for partial differential equations

Matteo Santacesaria, *University of Helsinki*

Inverse problems is a growing field in mathematics whose aim is to understand how to recover physical quantities of an object from indirect measurements. Typical examples include X-ray tomography and Magnetic resonance imaging. In this talk we will present some inverse problems whose unknown quantities satisfy some partial differential equations. We will focus on Calderon's problem, an inverse boundary value problem which is the model of an imaging method called Electrical impedance tomography. The aim of the talk is to give a brief introduction to this research area, what are the main techniques, some open problems and new directions in the field.