

THE MATHEMATICS DEPARTMENT PRESENTS

A MATHEMATICS COLLOQUIUM

THURSDAY, December 6, 2007

BOND HALL 227

4:00 pm

Title: Optical Tomography

Speaker: Stephen McDowall, WWU

Abstract: “Optical tomography” is the use of near infrared light to probe a medium and thereby obtain information about the material makeup of the interior of the medium. It has been proposed as a safer and cheaper method of medical imaging than x-rays and MRI, both of which expose the patient to arguably unhealthy radiation. The physics of photon propagation is modeled by the transport equation which is in terms of the absorption and scattering properties of the medium; the problem of determining these properties from measurements on the boundary of the medium is an example of an inverse boundary value problem. The major mathematical accomplishments in this problem were made in 1996, (a refinement in 1999), and 2003. In these works the geometry is assumed to be Euclidean, which means that the refractive index of the medium is assumed to be constant. I have been studying the analogous problem when the index of refraction is allowed to vary (smoothly) and model the dynamics by way of Riemannian geometry. In this talk I will present the problem of optical tomography in Euclidean and Riemannian geometries and will present the major known results in both cases. More recently, the problem has been studied in the case that the measurements available are more limited, and are more realistic when compared to those attainable in a laboratory setting. I will describe this problem and the results proven in Euclidean geometry and then present my extensions to the Riemannian setting.

The talk will be primarily an introduction to optical tomography and a survey of results. However, I expect there will be time to present some of the ideas involved in proving the results there is a common thread in all the proofs which is relatively easy to understand and is well motivated by the dynamics of scattering.

Refreshments will precede the talk at 3:30pm in Bond Hall 300
courtesy of Susan Kaplan.