University of Oregon
Department of Mathematics

Moursund 2007 Lectures

May 23rd – May 25th

Gerhard Huisken

Max Planck Institute of Gravitational Physics (Albert Einstein Institute)

In Postdam Germany

A tea will precede lectures at 3:30 p.m
&
A reception will follow the Wednesday lecture in 219 Fenton Hall

LECTURE 1

Wednesday, May 23rd, 4pm
221 McKenzie

"The heat equation and uniformisation in geometry"

Abstract:
Geometric versions of the heat equation can be used to deform a given geometrical object into a "nicer" or even canonical representative inside a certain class. Examples for this phenomenon are Hamilton's flow of Riemannian metrics by their Ricci curvature and the mean curvature flow of hypersurfaces. Recently the reach of these deformations has been greatly enhanced by controlling and extending them beyond singularities. The lecture explains recent work by Huisken and Sinestrari on surgery in mean curvature flow and explains the relation to the work of Hamilton and Perelman on the Ricci flow.

LECTURE 2

Thursday, May 24th, 4pm
204 Villard

"Isoperimetric inequalities and the concept of mass in General Relativity"

Abstract:
Isoperimetric inequalities have a long history in Geometry and Analysis, motivating conceptual progress in these areas of mathematics for many centuries. They also paved the way to the understanding of many related variational problems in Mathematical Physics. The lecture describes modern analytical approaches to the age old isoperimetric problem and explains how a deviation from the standard isoperimetric inequality in curved spaces can be used to develop a natural new concept for the mass of isolated gravitating systems such as stars and black holes in General Relativity.

LECTURE 3

Friday, May 25th, 4pm
205 Deady

"Isoperimetric inequalities via Geometric evolution equations"

Abstract:
To prove isoperimetric inequalities, one strategy consists in sweeping out a given bounded region by a family of hypersurfaces
controlled by a suitable geometric evolution equation. The lecture explains how the flow of a surface in direction of its mean curvature vector discussed in the first lecture can be used in conjunction with inverse mean curvature flowto control isoperimetric properties of an enclosed region. Such inequalities then justify the concept of mass introduced in the previous lecture.