

MATHEMATICS SEMINAR  
of the  
UNIVERSITY OF LUXEMBOURG  
in cooperation with the  
LUXEMBOURG MATHEMATICAL SOCIETY

**June 2010**

**1 June 2010, at 5 pm**

**Room B.02**

Jean-Louis Tu  
Paul Verlaine University, Metz

~~TBA~~ The Baum-Connes and the coarse Baum-Connes conjecture

Let  $G$  be a locally compact group. The Baum-Connes conjecture allows to compute the  $K$ -theory group of the reduced  $C^*$ -algebra of  $G$ . It is related to many domains of mathematics such as differential geometry, index theory, harmonic analysis and geometry of groups. We will present a survey of some past and recent developments on this subject.

**15 June 2010, at 5 pm**

**Room B.02**

Vincenzo Nesi  
University of Rome 1, La Sapienza

**Planar harmonic maps**

Abstract

A planar harmonic mapping  $U = (u^1, u^2)$  on the unit disk  $B \subset \mathbb{R}^2$  is simply a pair of harmonic functions on  $B$ . The theme of the talk is establishing conditions under which  $U$  is a global homeomorphism.

Given a homeomorphism  $\Phi$  of  $\partial B$  onto a simple closed Jordan curve  $\gamma$ , set  $D$  to be the simply connected bounded open set determined by  $\gamma$ . A classical result of H. Kneser (1926) establishes that, if  $D$  is convex, the harmonic extension of  $\Phi$  is a homeomorphism of  $\bar{B}$  onto  $\bar{D} \equiv \gamma \cup D$ .

I will then present the main result. If  $\Phi \in C^{1,\alpha}(\partial B)$ , then we give a necessary and sufficient condition for  $U$  to be a diffeomorphism of  $\bar{B}$  onto  $\bar{D}$  so providing a sharp version of H. Kneser's Theorem. Finally, if time permits, I will present versions of Kneser's theorem which are valid when considering  $L^\infty$  elliptic operators rather than the Laplace operator with applications to composite materials. The talk is based upon a joint work with Giovanni Alessandrini, Università degli Studi di Trieste.