SIMION STOILOW INSTITUTE OF MATHEMATICS

OF THE ROMANIAN ACADEMY

IMAR Monthly Lectures

Wednesday, March 26, 2014

11:00 – 12:00 **Melvin Fitting** (CUNY, Lehman College): *Realization implemented*

Abstract: Justification logics began with Sergei Artemov's completion of Gödel's project to find an arithmetic semantics for intuitionistic logic. Along the way, a family of modal-like logics has been created in which explicit justifications for truth are part of the language. These connect to conventional modal logics via realization theorems. All this will be explained. Realization theorems have both constructive and non-constructive proofs, depending on the modal logic in question. I will provide a new and simpler path to constructive realization proofs, going through an intermediate quasi-realization stage. Quasi-realizers are easier to produce than realizers. Quasi-realizers in turn constructively convert to realizers. Then I will briefly demonstrate a Prolog implementation of quasi-realization, and quasi-realization to realization conversion, for Artemov's original justification logic, LP, standing for "logic of proofs".

12:00 – 12:30 *Coffee break*

12:30 – 13:30 **Bernard Helffer** (Univ. Paris-Sud): *Dirichlet eigenfunctions of the square membrane: Courant's property, and A. Stern's and Å. Pleijel's analyses.*

Abstract: The celebrated nodal domain theorem by Courant says that the number of nodal domains of an eigenfunction associated with a k-th eigenvalue of the Dirichlet Laplacian (eigenvalues listed in increasing order) should be less than or equal to k. Pleijel proved that equality holds only for finitely many values of k. In this case we speak of the Courant sharp property. If we look at the square, it is immediate that the first, second and fourth eigenvalues are Courant sharp. In this talk we will discuss some missing arguments in Pleijel's paper leading to the conclusion that there are no other cases. We also discuss some results of Antonie Stern who was a PhD student of R. Courant and defended her PhD in 1924. Finally, we will describe the link with the question of minimal partitions.

This is a joint work with P. Bérard.