Mathematics, Statistics, and Computer Science **@ UIC**

Logic Seminar

Continuous vs Discrete via Nonstandard Analysis

Evgeny Gordon (Eastern Illinois University)

Abstract: In the second half of the last century a new point of view on interrelation between the continuous and discrete mathematics started to become popular among applied mathematicians. According to it the continuous mathematics is an approximation of the discrete one, but not vice versa. The reason of this popularity is the widespread use of computers in both applied and theoretical research. However, the formalization of mathematics based on this point of view meets serious difficulties in the framework of Cantor's Set Theory, because we need to deal with not well defined collections, like very big numbers, or numbers far enough of boundaries of computer memory, that depend on concrete problems or points of views. Maybe, the difficulties in mathematically rigorous justification of theoretical physics have the same reason the axiom of least upper bound is too strong idealization for physics. A new axiomatic system (**NNST** — Naive Nonstandard Set Theory) based on ideas of A. Robinson's Nonstandard Analysis and P. Vopenka's Alternative Set Theory will be presented in this talk. The idea of approximation of discrete structures by continuous ones is implemented in this theory as follows. Continuous structures appear from finite *very big finite ones* as factorizations of *accessible substructures* of these finite structures by some *indiscirnability relations*. The properties in italic here are not well defined ones. We discuss some theorems formulated and proved in the framework of NNST related to computer simulations of continuous structures, which have clear intuitive sense, can be monitored in computer experiments, but whose formulations in the framework of

Tuesday, November 10 at 4:00 PM in SEO 427

Cantor's Set Theory are irrelevant, if not to say unreadable.

Tuesday, November 10 at 4:00 PM in SEO 427