Department of Mathematics
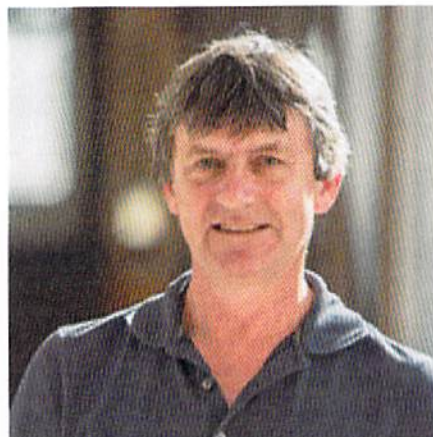## University of Notre Dame

LOGIC SEMINAR

Guest Speaker: Sergei Starchenko
University of Notre Dame

Date: Tuesday, November 12, 2019
Time: 2:00 PM
Location: 125 Hayes-Healy Hall

Lecture Title:
Model-theoretic generalizations of the Elekes-Szabo Theorem

Abstract

Erdos and Szemeredi observed the following sum-product phenomenon: there is some $c > 0$ such that for any finite set A of reals, $max|A + A|, |A * A| > |A|^{1+c}$. Later, Elekes and Ronyai generalized this by showing that for any polynomial $f(x, y)$, we must have $|f(A * A)| > |A|^{1+c}$, unless f is either additive or multiplicative (i.e., of the form $g(h(x) + i(y))$ or $g(h(x) * i(y))$ for some univariate polynomials g, h, i, respectively). A remarkable theorem of Elekes and Szabo provides a conceptual generalization, showing that for any polynomial $F(x, y, z)$ such that its set of solutions has dimension 2, if F has a maximal possible number of zeroes n^2 on finite n-by-n-by-n grids, then F is in a finite-to-finite correspondence with the graph of multiplication of an algebraic group (in the special case above, either the additive or the multiplicative group of the field). We present a generalization of this result to hypergraphs of any arity definable in a large class of stable structures, including differentially closed fields, as well as a version for o-minimal structures. We will discuss in detail some of the main ingredients of the proof. Joint work with Artem Chernikov and Kobi Peterzil.