Quasirandom and common combinatorial structures

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A combinatorial structure is said to be quasirandom if it resembles a random structure in a certain robust sense. The notion of quasirandom graphs, developed in the work of Rödl, Thomason, Chung, Graham and Wilson in 1980s, is particularly robust as several different properties of truly random graphs, e.g., subgraph density, edge distribution and spectral properties, are satisfied by a large graph if and only if one of them is. A closely related notion is the notion of common graphs, which are graphs whose number of monochromatic copies is minimized by the (quasi)random coloring of a host complete graph.

We will discuss quasirandom properties of various combinatorial structures and present several recent results obtained using analytic tools of the theory of combinatorial limits. We will then present some recent results on common and locally common graphs, in particular, we show that there exists common connected graphs with arbitrary large chromatic number, whose existence was an open problem for more than 20 years. At the end of the talk, we will mention an extension of the notion of common graphs in the algebraic setting.

The talk is based on results obtained with different groups of collaborators, including Timothy F. N. Chan, Jacob W. Cooper, Robert Hancock, Adam Kabela, Ander Lamaison, Taísa Martins, Roberto Parente, Samuel Mohr, Jonathan A. Noel, Sergey Norin, Péter Pál Pach, Yanitsa Pehova, Oleg Pikhurko, Maryam Sharifzadeh, Fiona Skerman, Jan Volec and Fan Wei.