Graph limits and Markov spaces

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Limit objects for sequences of finite structures, larger and larger in size but more and more similar in some sense, have been constructed sporadically, perhaps since von Neumann constructed continuous geometries, but this research has become quite extensive in the last decade and a half. Graphs are perhaps the simplest structures, and accordingly, the limit theory of graphs has made the most progress. The theory of graph limits is only understood, to a somewhat satisfactory degree, in the cases of bounded degree graphs (initiated by Benjamini and Schramm) and of dense graphs (initiated by Borgs, Chayes, Lovász, Szegedy, Sós and Vesztergombi). More recently there is a lot of interest in the intermediate cases. It appears that the most important constituents of graph limits in the general case will be Markov spaces (Markov chains on measurable spaces with a stationary distribution). Several important theorems can be extended from finite graphs to Markov spaces, more generally, to measurable spaces: flow theory, expanders and spectra, mixing of random walks, etc. In this talk we will give a glimpse into this emerging theory, based on the work of Á. Backhaus, D. Kunszenti-Kovács, B. Szegedy and the speaker.