Colloquium Series
Department of Mathematics and Statistics

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The predictable dance of random walk

Abstract: Dating back to its initial investigation by G. Pólya in 1919 and the pioneering work of H. Kesten in the 1950s, the theory of random walks on groups has reached a high level of sophistication and has seen applications to biology, chemistry, economics, physics, and, famously, card shuffling. Throughout this theory, it is common to assume that a given random walk is aperiodic and/or irreducible. While these prevailing assumptions make particularly tractable the analysis of random walk and help to highlight its diffusive nature, they eliminate a prevalent phenomenon: its dance. This dance can be seen, for example, in the so-called simple random walk on $\mathbb{Z}$ where a random walker dances back and forth between even and odd integers. In this work, we develop a general theory for random walks on finite-generated abelian groups without making any assumptions concerning aperiodicity or irreducibility. Stated in the context of a finitelygenerated abelian group G, our main result is a local (central) limit theorem that provides a large-time asymptotic approximation of the location of a random walker. Generalizing the ubiquitous Gaussian approximation, our asymptotic is given as a product of two functions, one which describes the diffusion and the other which describes the dance. Interestingly, the "dance function" is gotten as a Haar integral over a compact subgroup of G's Pontryagin dual. This talk is based on joint work with Yutong Yan.

Wednesday, Feb. 12, 1:05 – 1:50 pm in 1-309