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p-Adic Brownian Motion as a Limit of Discrete Time Random Walks.

A large class of diffusion equations in the p-adic setting give rise to p-adic analogs of brownian motion. We show that these stochastic processes are limits of discrete time random walks on grids. The current work generalizes previous results by allowing for diffusion equations associated to Vladimirov operators with exponents greater than zero rather than greater than one, as was previously studied. We obtain stronger results in this more general setting as well. In particular, the proof of the weak-$*$ convergence of the measures associated to discrete time processes to their continuum limits was previously valid only for path spaces with compact time intervals. We extend this proof to the setting of path spaces with unbounded time intervals.

This current study is a part of a larger program to extend physical models to non-Archimedean settings. Since the Archimedean axiom is fundamentally a statement about subdivision of physically measurable quantities and measurement fails at the Planck scale, the study of physics at ultra small distance and time scales may involve non-Archimedean structures. We will comment on the relationship of the current study to the broader research theme and pose some open problems that should merit further investigation. (Received September 17, 2019)