Nonstandard analysis, a powerful machinery derived from mathematical logic, has had many applications in probability theory as well as stochastic processes. Nonstandard analysis allows construction of a single object—a hyperfinite probability space—which satisfies all the first order logical properties of a finite probability space, but which can be simultaneously viewed as a measure-theoretical probability space via the Loeb construction. As a consequence, the hyperfinite/measure duality has proven to be particularly in porting discrete results into their continuous settings.

In this talk, for every general-state-space discrete-time Markov process satisfying appropriate conditions, we construct a hyperfinite Markov process which has all the basic order logical properties of a finite Markov process to represent it. We show that the mixing time and the hitting time agree with each other up to some multiplicative constants for discrete-time general-state-space reversible Markov processes satisfying certain condition. Finally, we show that our result is applicable to a large class of Gibbs samplers and Metropolis-Hasting algorithms.