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A historical law of large numbers for the Marcus-Lushnikov process

par **Stéphanie Jacquot**

The Marcus-Lushnikov process is a finite stochastic particle system, in which each particle is entirely characterized by its mass. Each pair of particles with masses x and y merges into a single particle at a given rate $K(x, y)$. Under certain assumptions, this process converges to the solution to the Smoluchowski coagulation equation, as the number of particles increases to infinity. The Marcus-Lushnikov process gives at each time the distribution of masses of the particles present in the system, but does not retain the history of formation of the particles. We set up a historical analogue of the Marcus-Lushnikov process (built according to the rules of construction of the usual Markov-Lushnikov process) each time giving what we call the historical tree of a particle. The historical tree of a particle present in the Marcus-Lushnikov process at a given time t encodes information about the times and masses of the coagulation events that have formed that particle. We prove a law of large numbers for the empirical distribution of such historical trees. The limit is a natural measure on trees which is constructed from a solution to the Smoluchowski coagulation equation.

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