

Breaking the Brownian chain: time and place

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Interacting Brownian particles are a popular model for various physical systems where a number of particles is subjected to inter-particle forces and ambient noise. We investigate in depth the behaviour of one such model studied earlier both by physicists and mathematicians: a finite chain of Brownian particles, interacting through a pairwise quadratic potential, with one end of the chain fixed and the other end pulled away at slow speed. We study the instant when the chain “breaks”, that is, the distance between two neighboring particles becomes larger than a certain limit. There are three different regimes depending on the relation between the speed of pulling and the Brownian noise. We prove weak limit theorems for the break time and the break position for each regime. The main tools used are weak dependence (Kolmogorov-Rozanov mixing theorem) and Piterbarg-Pickands theorem on Gaussian large deviations.