

Limit Shape of Single-Source Stochastic Sandpiles with p -topplings on $\mathbb{Z}$

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The Abelian sandpile model is a model of mass distribution in which particles accumulate on the vertices of a graph and unstable vertices topple deterministically by distributing particles to their neighbors. We study a stochastic variant of the single-source model on $\mathbb{Z}$, where $n \in \mathbb{N}$ particles are placed at the origin. Unstable vertices topple according to the p -toppling rule, sending a particle to each neighbor independently with probability $p \in (0, 1)$. We show that as $n \rightarrow \infty$, the macroscopic limit shape of the final stable configuration is a symmetric interval around the origin and establish a central limit theorem for the boundary fluctuations: after proper rescaling, they converge to a Gaussian distribution.