Metastability and condensation in inclusion processes

Sander Dommers

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The inclusion process is an interacting particle system where each particle at a site x jumps to site y at rate $(d+\eta_y)r(x,y)$, where d is a diffusion parameter, η_y is the number of particles on site y and r(x,y) is the jump rate from x to y of an underlying random walk. This means that it is more likely that particles jump to a site that already has a lot of particles. We mainly focus on reversible versions of this process.

When the diffusion d tends to 0 as the number of particles tends to infinity, a very strong condensation phenomenon occurs where all particles cluster together. Once such a condensate is formed the particles stick together and the condensate performs a random walk itself on much longer timescales, which can be seen as metastable (or tunneling) behavior. These inclusion processes give rise to a rich picture, where metastability occurs on multiple timescales.