

## Application of a steady states transport model to condensation of water droplets on a substrate

Hannes Nagel<sup>1\*</sup>, Jürgen Vollmer<sup>2,3</sup>, Wolfhard Janke<sup>1</sup>

<sup>1</sup>Institut für Theoretische Physik, Universität Leipzig, Leipzig, Germany

<sup>2</sup>Max-Planck-Institut für Dynamik und Selbstorganisation, Göttingen, Germany

<sup>3</sup>Fakultät für Physik, Georg-August-Universität Göttingen, Göttingen, Germany

\*hannes.nagel@itp.uni-leipzig.de

Condensation of water droplets on a substrate proves as a good test ground for condensation phenomena in basic stochastic transport processes. The modeled physical situation consists of a substrate at constant temperature exposed to a constant influx of microscopic water droplets from surrounding vapor.

We consider a simple one-dimensional stochastic transport process with constant particle influx. This process can be parameterized so that particles condense to droplets.

The employed transport model consists of a periodic lattice and a gas of indistinguishable particles, so that each site  $i$  is occupied by zero or  $m_i$  particles. At every time step a random site  $i$  is chosen and a particle may leave to an adjacent site with probability proportional to a hopping rate  $u(m_i|m_{i-1}, m_{i+1})$ . The hopping rate is chosen so that particles tend to condensate by incorporating a zero-range repulsive interaction and surface tension like short-range interaction [1]. The envelope shape of condensates can be tuned to have the same scaling of volume to droplet width as real droplets [2]. Particle influx from environmental vapor is mimicked by adding at random sites randomly with a constant influx rate.

We compare our observations with a recent study of water droplet size distributions obtained in experiment and simulation by Blaschke et al. [3]. In the experiment water vapor condenses on a glass substrate. The simulation mimics experiment by adding a new constant initial volume droplet at some point to the substrate and subsequently merging any overlapping droplets at every time step.

In contrast to the previous simulations [3] our model intrinsically includes diffusion of particles and droplet merging occurs due to movement as well as particle placement in the influx step.

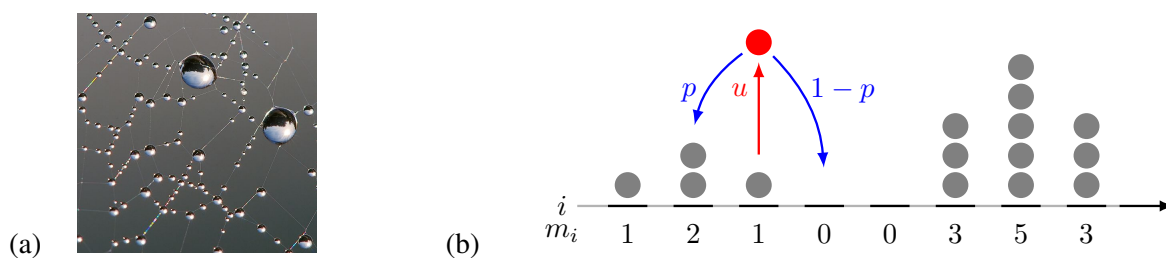


Figure 1: (a) Droplets of various sizes on a cobweb (Image credits: Luc Viatour/lucnix.be) (b) Scheme of the employed particle hopping model. Additional to normal diffusion, the asymmetry parameter  $p$  can be used to create directional flow mimicking drift of droplets.

### References

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