Statistical Mechanics far from Equilibrium

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Virginia Tech DMR-0414122

Coarsening (or condensation) is a familiar, relatively well understood, phenomenon. Often, *dynamic scaling* is manifested: A system with larger clusters at a later time, when rescaled appropriately, appears to be the same as at an earlier time. To illustrate this idea, 3 "original" frames were rescaled and superimposed in the figure at far right. Typically, clusters grow with time as $t^{1/2}$ or $t^{1/3}$. However, systems evolving according to "non-equilibrium" dynamics frequently display "anomalous" scaling. Shown here is a simple model of biased diffusion of two species (black/white particles in the figure, biased to move up/down). The jams here ("clouds") are found to grow as $t^{0.44}$.

D.A. Adams, B. Schmittmann and R.K.P. Zia, to be published.
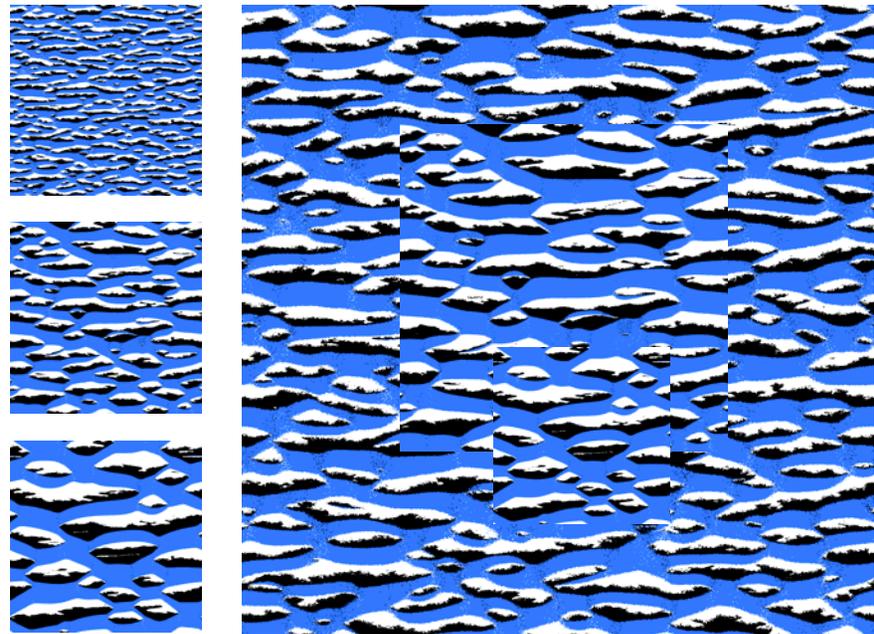
Coarsening of "clouds"

The small frames on the left are snapshots of the process at t = 1024, 4096, 16438 MCS. Appropriately scaled versions of these are superimposed to form the large picture on the right. A casual glance does not reveal the three different scenes, demonstrating that a system at a later time (scaled suitably) blends in well with the system at an earlier time.

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Education and outreach:

As our project involves a wide spectrum of techniques, it is natural that both undergraduates (*David Adams*, *Brian Skinner*) and graduate (*Jiajia Dong*, *Sayak Mukherjee*) students form a core component of our research. In addition, four postdocs (*Andrew Angel, Suman Banik, Izabella Benczik, and Yong Wu*) and two international [IAESTE] interns (*Uli Dobramysl and Meiwa Liu*) are supported in part by this grant. While junior researchers often discover new phenomena through computer simulations of simple models, full-scale and analytic studies are implemented by the more senior scientists. The work outlined here is carried out by *David Adams*, a Senior double majoring in Physics and Computer Science.

From left, back row: Suman Banik, David Adams, Royce Zia, Andrew Angel; middle row: Uli Dobramysl, Sayak Mukherjee, Meiwa Liu; front row: Beate Schmittmann, Jiajia Dong.
Not in photo: Izabella Benczik, Brian Skinner, Yong Wu.