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Langmuir Prize Talk: Pathways to forming glass: bubbles in space-time

DAVID CHANDLER, University of California, Berkeley

This lecture describes a perspective of glass-forming materials that I have helped Juan P. Garrahan develop. It is based upon the structure of trajectory space. Illustrations of this perspective are most often drawn from so-called “facilitated” or “kinetically constrained” lattice models. With these models, glassy dynamics emerges from the metric or geometrical constraints for molecular motion. More detailed atomistic models, and presumably natural glass formers as well, behave similarly. In the $d+1$ dimensions of trajectory space, one finds order-disorder phenomena that can be organized according to scaling and universality classes. Various predictions from this viewpoint, some yet to be verified experimentally, will be discussed.