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Soft spots in amorphous thin films: a structural signature of free surfaces DANIEL SUSSMAN, ANDREA LIU, University of Pennsylvania, SIDNEY NAGEL, University of Chicago — While it is known that the dynamics in thin films strongly depend strongly on the distance from a free surface, standard measures of the static structure in these systems (e.g., the density, the radial distribution function, or the distribution of under-coordinated particles) typically find at most a monolayer of particles at the surface that differ from those in the bulk. We investigate energy-minimized, thin-film configurations of Lennard-Jones particles and find that the presence of a free surface leads to low-energy vibrational surface modes with properties very different from those in the bulk. By analyzing the structure of these modes, we find that the density of "soft spots," local regions of high mode amplitude, is higher near the surface. These soft spots have well-defined length scales characterizing both how far they penetrate into the bulk and how extended along the surface each one is. Furthermore, these soft spots have a high correlation to particle rearrangements or enhanced mobility. We discuss the implications of surface soft spots for existing results on glassy thin films.

Daniel Sussman
University of Pennsylvania

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