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Structural signatures of dynamic heterogeneities in monolayers of colloidal ellipsoids

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When a liquid is supercooled towards the glass transition, its dynamics drastically slows down, whereas its static structure remains relatively unchanged. Finding a structural signature of the dynamic slowing-down is a major challenge, yet it is often too subtle to be uncovered. Here we discovered the structural signatures for both translational and rotational dynamics in monolayers of colloidal ellipsoids by video microscopy and computer simulations. The dynamic slowest-moving clusters, the static glassy clusters and low-entropy clusters are strongly correlated with the same power-law divergence as the correlation length of the dynamic heterogeneity, demonstrating that the kinetic slowing down is caused by the decrease in the structural entropy and the increases in the glassy cluster size. Ellipsoids with different aspect ratios exhibit one-step or two-step glass transitions with distinct dynamic heterogeneities. These findings demonstrate that the particle shape anisotropy has important effects on the structure and dynamics of the glass.