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Glasses and Crystals: three studies from current work

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Transitions between the glassy, liquid and crystalline states are central in materials science. In this talk, we build on established work and briefly present new unpublished results on:

- Ice nucleation and glass formation in living systems, dealing with ice-nucleating agents (INAs) and antifreeze proteins (AFPs). The control of ice nucleation is essential for the survival of some species, and has implications for climate. New work links the action of INAs and AFPs, leading to straightforward predictions. • The strain-hardening of conventional engineering alloys underpins their importance in structural applications. Metallic glasses have some attractive mechanical properties, but are generally understood to show not strain-hardening, but rather strain-softening, leading to catastrophic premature failure. It is newly understood that strain-hardening of metallic glasses can result from prior rejuvenation, or from deformation-induced crystallization. The latest work explores record-breaking strain-hardening rates and their implications.

- Ultra-fast calorimetry permits exploration of fast crystallization, of relevance for example in phase-change computer memory. We probe the extent to which calorimetry can serve to elucidate temperature-dependent kinetics in the liquid state, including kinetic fragility and strong-to-fragile transitions