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Experiments on the morphology of icicles ANTONY SZU-HAN CHEN, STEPHEN W. MORRIS, Department of Physics, University of Toronto — Icicles form when cool water drips from an overhanging support into air whose temperature is below freezing. Ice growth is controlled by the removal of latent heat, which is transferred into the surrounding air via a thin film of water flowing over the ice surface. Predicting the shape of an icicle is a non-trivial free-boundary growth problem. The global shape emerges from the local physics of the water film, the advection-diffusion of latent heat, and the slowly evolving surface position [1]. The ice-water interface can also become unstable to form ripple patterns on the icicle surface [2]. We conducted controlled icicle experiments [3], using a table-top icicle-growing apparatus. We used image analysis to probe the evolution of both the icicle shape and the rippling instability, and we investigated their dependence on ambient temperature, water supply rate, salinity, and surface tension. Our experiments showed that under certain conditions, icicles have self-similar global profiles, but non-uniformities such as tip splitting can sometimes occur. We also found that ripple formation is correlated to the purity of water used, and the ripples climb the icicle during growth.

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