Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

The Platonic Ideal of Stalactite Growth MARTIN SHORT, JAMES BAYGENTS, WARREN BECK, DAVID STONE, RAYMOND GOLDSTEIN, University of Arizona, RICKARD TOOMEY, Kartchner Caverns State Park — The chemical mechanisms underlying the growth of cave formations such as stalactites are well-known, yet no theory has yet been proposed which successfully accounts for the dynamic evolution of their shapes. Here we consider the interplay of thin-film fluid dynamics, calcium carbonate chemistry, and CO_2 transport in the cave to show that stalactites evolve according to a novel local geometric growth law which exhibits extreme amplification at the tip as a consequence of the locally-varying fluid layer thickness. Studies of this model show that a broad class of initial conditions is attracted to an ideal shape which is strikingly close to a statistical average of natural stalactites. A linear stability analysis shows is used to explain the instability of this state to the formation of centimeter-scale ripples, as commonly seen on a wide range of speleothem surfaces.

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Date submitted: 28 Nov 2004 Electronic form version 1.4