

Abstract Submitted
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On the origin of draperies structures in limestone caves: two-dimensional analysis of the impulse response¹ PIER GIUSEPPE LEDDA, LFMI, EPFL, Lausanne, Switzerland, GIOELE BALESTRA, iPrint Institute, University of Applied Sciences and Arts of Western Switzerland, Fribourg, Switzerland, GAETAN LERISSON, LFMI, EPFL, Lausanne, Switzerland, BENOIT SCHEID, TIPs, ULB, Bruxelles, Belgium, MATTHIEU WYART, PCSL, EPFL, Lausanne, Switzerland, FRANCOIS GALLAIRE, LFMI, EPFL, Lausanne, Switzerland — We investigate the role of hydrodynamic instabilities in the morphogenesis of typical draperies structures encountered among other speleothems in limestone caves. The problem is tackled using the lubrication approximation for the fluid film flowing under an inclined plane, in the presence of substrate perturbations that grow according to a classical deposition law. We generalize to the two-dimensional case the spatio-temporal analysis of the linear impulse response resulting from linear simulations. We exploit the concepts of Riesz transform and monogenic signal, the multi-dimensional complex continuation of a real signal, to retrieve the asymptotic properties of the wavepacket. The isotropy of the pure hydrodynamic solution is broken and the deposition process selects predominant streamwise structures on the substrate as the response is advected away. Furthermore, the presence of an initial localized perturbation on the substrate produces a quasi-steady region characterized by streamwise structures both in the fluid film and on the substrate. We suggest that these linear selection mechanisms contribute to the formation of draperies under inclined cave ceilings.

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