LadHyX Seminar – June 18th, 10:45

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Flow-driven precipitation:
a lab model of hydrothermal chimney morphogenesis.

Hollow mineral tubes form spontaneously at the interface between reactive fluids of contrasting density. The Lost City hydrothermal field, discovered in 2000 in the Atlantic Ocean, provides a striking example: alkaline hydrothermal fluids, lighter than the surrounding magnesium-rich seawater, rise as buoyant jets from the seafloor. As they mix with seawater, an insoluble mineral precipitate forms at their interface, shaped by hydrodynamic processes. The resulting porous mineral wall gradually confines the flow while maintaining concentration gradients, giving rise to towering carbonate and brucite chimneys that can reach up to 50 meters in height. These remarkable self-organized structures emerge from the continuous interplay between fluid flow, ionic transport through the porous wall, and the precipitation reaction itself. Yet the physical mechanisms governing the growth and morphology of hydrothermal chimneys remain poorly understood. In this study, we focus on buoyant jet–templated brucite tubes, which represent the delicate early-stage structures in chimney formation. Laboratory model experiments allow us to explore how fluid flow and reactive transport interact to shape these tubes, providing insight into the processes that initiate vent growth.