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Terracing on comets via multi-scale sublimation

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Abstract

Terracing is common on all cometary surfaces and has been attributed to processes that range from accretion, such as from low-velocity impacts of cometesimals [1], to evolutionary, such as deposition of dust or sublimation. All of these processes likely play a role in the formation of some terraces. However, the observation of terracing at all scales on comets, from tens of meters [*e.g.*, 2] to millimeters [*e.g.*, 3, 4] reveals a fractal morphology that requires a scale-independent and widespread formation process [5]. Although the bulk of cometary activity is now known to arise from only a small fraction of the surface [2, 6, 7], low-level sublimation is nonetheless common and must occur at the scale of grains.

We are therefore exploring the possibility that terracing, particularly on cm to mm scales can be produced from backwasting of sublimation fronts. In particular, we are examining the role of inhomogeneities in seeding and propagating sublimation to produce the long curvilinear terraces observed on comets. Potential non-uniformities include porosity, composition, particle size, and insolation. Laboratory experiments using the SCITEAS-2 simulation chamber in the Ice Laboratory of the University of Bern [8] are underway to explore how these components affect the small-scale morphology resulting from sublimation and allow us to develop physical models that can be used to aggregate these effects to large scales. Future experiments will make use of the research infrastructure being built within the CoPhyLab project [9].

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