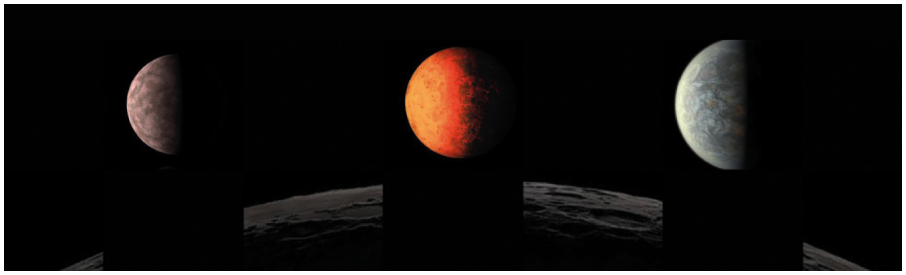

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Geological reality and magma propagation models: accounting for fracturing

Friday 24 October 2025 18:00 (1 hour)

Understanding magma propagation mechanisms and ascent paths towards the surface is essential in interpreting deformation features such as dyke-induced grabens and intrusive domes at the surface of rocky planetary bodies, and characterizing the underlying volcanic and igneous plumbing systems (VIPS). Forward models reveal dominant mechanisms of magma propagation below the surface. Those forward models then inform numerical inversions of geophysical data. The majority of those models assume that magma propagation trajectories can be satisfactorily described by the opening of a tensile crack in a homogeneous, linearly elastic crust. This presentation will show where non-elastic deformation processes may dominate instead. Results show that pre-existing structural fabrics can guide dike trajectories, that intrusion tip geometry and progressive host rock damage affect changes in propagation mode over time, that standard inversion methods fail to accurately estimate parameters of analogue intrusions from experimental surface displacements, and that simulating dynamic fracturing in host rocks during magma propagation is essential in capturing realistic patterns of host rock displacement, stress and strain. This work shows that it is essential to improve our insights of the role of geological complexities in steering magma intrusion trajectories to drastically improve our understanding of VIPS on rocky planetary bodies such as the Moon, Mars, and beyond.

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