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To Flow of Not To Flow? Granular (tribo)charge and discharge (through an orifice) in low gravity

Models applicable on Earth tend to fail in low gravity. Beyond a critical gravitational acceleration, cohesive forces become predominant, resulting in a shift in macroscopic behavior. For granular processing in space, notably to sustain human presence on the Moon, this can have disastrous consequences; yet, the influence of (low) gravity on granular flows is not always accounted for in existing models. I will present results from hopper discharge experiments conducted in low gravity using an active drop tower and parabolic flights. The flow rate and clogging probability are measured for different materials. Results show an increased clogging probability and deviations from the generally accepted gravity-scaling of the Beverloo equation. I propose to generalize granular behavior in low gravity by scaling results using the ratio of granular cohesion-to-weight (the granular Bond number). Going one step beyond, I will discuss the possibility to use low gravity to tweak a material's cohesion (or rather, the predominance of cohesion) without any modification to the material itself, notably for studying the effect of tribocharging on granular flows.