

# Complex motion and enhanced thermal properties of dense granular media

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## **Abstract.**

A seminal set of experiments on continuously sheared granular media reveals vortex-like structures with short lifetime and significant intensity. In classical fluids, vortices have long been known to significantly enhance heat transfer via convective dispersive internal mixing, but in engineering and geophysical analyses of heat flow through granular media this has been continuously neglected. Computer simulations that capture the vortices in the granular media unravel astonishing convective heat fluxes from the dispersion, which challenge the previous paradigm, and inspire new technologies and continuum models.