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Patterns, Segregation and Hysteresis in Vertically Vibrated Granular Mixtures ISTAFAUL ANSARI, MEHEBOOB ALAM, Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur PO, Bangalore 560064, India — Granular materials under vertical shaking exhibit a variety of interesting phenomena: undulations, surface instabilities, oscilons, ripples, Leidenfrost state and convection. We have investigated these phenomena by conducting experiments on two types of equimolar *binary* granular mixtures: (i) glass and steel balls both having diameters of $d = 1.0\ mm$ and a density ratio of $\rho_s/\rho_g = 3.0$ and (ii) the delrin and steel balls both having diameters of $1.0\ mm$ and a density ratio of $\rho_s/\rho_d = 5.5$. The particles are held in a quasi-two-dimensional Perspex container which is vibrated harmonically in vertical direction using an electromagnetic shaker. All the experiments are done by increasing the shaking intensity (measured in terms of dimensionless shaking acceleration Γ) while keeping the shaking amplitude A/d fixed. We uncovered many unhitherto reported novel patterns: (i) the Leidenfrost state coexisting with a granular gas, (ii) horizontal segregation within a Leidenfrost state, (iii) granular convection with a floating particle cloud, and (iv) both vertical and/or horizontal segregation with other patterned states. We further show that the transition from the Leidenfrost state to convection in a binary mixture occurs via a hysteretic transition.

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