Anomalous diffusions of granular rafts and oscillons on Faraday waves

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Particles floating on the liquid interface can aggregate and form a granular raft, which affects the interface property and induces several interesting phenomena, like wrinkle pattern or encapsulation process. However, for particles on the wavy water surface, such as marine debris on a sea surface, the response of wave-particle mutual interaction is still elusive. Here, we experimentally investigate the spatiotemporal evolution of granular rafts on the surfaces of Faraday waves, and their interaction with oscillons, parametrically generated by vertically oscillating a water tank. The diffusive light photography is used to reconstruct the 2+1D spatiotemporal wave height evolution and the rafts motion. The raft tend to exhibit small amplitude cage rattling in the oscillating confining cage by surrounding oscillons in the short time regime and persistent hopping in the long time regime. Increasing raft size averages out the oscillating effect and suppresses short anti-persistent diffusion. However, it deteriorates the spatial ordering of surrounding oscillons, which enhances the persistent hopping of the surrounding oscillons, weakens the caging effect by oscillons, and enhances the persistent diffusion in the long time regime.