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Kepler orbits in the Stokesian sedimentation of discs[1] RAHUL CHAJWA, NARAYANAN MENON, SRIRAM RAMASWAMY, TIFR Centre for Interdisciplinary Sciences, 21 Brundavan Colony, Osman Sagar Road, Narsingi, Hyderabad 500 075 — We study experimentally the settling dynamics of a pair of falling discs in a viscous fluid (Re $\sim 10^{-4}$), in a quasi-two-dimensional geometry with the vector normal to the discs, and the trajectory of the centres of the discs, lying in a plane. For initial conditions that are symmetric about the settling direction, we find periodic or scattering orbits of the settling pair [S. Jung et al., PRE **74**, 035302 (2006)], and account for these in a purely far-field analysis [S. Kim, Int J Multiphase Flow **11**, 699 (1985)]. In particular, we show that the problem of a symmetrically settling pair of spheroids can be mapped to the Kepler two-body problem. The solution to this problem gives a sharp transition between bound and scattering trajectories which is consistent with experimental observations. For initial conditions where the motions of the particles are not symmetric about the settling direction, we obtain yet another separatrix between full rotations and periodic oscillations which we study within an effective Hamiltonian description of this inertialess and entirely dissipative dynamical system.
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