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Hydrodynamic repulsion of elastic dumbbells MARIA L. EKIEL-JEZEWSKA, MAREK BUKOWICKI, MARTA GRUCA, Institute of Fundamental Technological Research, Polish Academy of Sciences — Dynamics of two identical elastic dumbbells, settling under gravity in a viscous fluid at low Reynolds number are analyzed within the point-particle model. Initially, the dumbbells are vertical, their centers are aligned horizontally, and the springs which connect the dumbbell's beads are at the equilibrium. The motion of the beads is determined numerically with the use of the Runge-Kutta method. After an initial relaxation phase, the system converges to a universal time-dependent solution. The elastic dumbbells tumble while falling, but their relative motion is not periodic (as in case of rigid dumbbells or pairs of separated beads). The elastic constraints break the time-reversal symmetry of the motion. As the result, the horizontal distance between the dumbbells slowly increases - they are hydrodynamically repelled from each other. This effect can be very large even though the elastic forces are always much smaller than gravity. [For the details, see M. Bukowicki, M. Gruca, M. L. Ekiel-Jezewska, J. Fluid Mech. 767, p. 95 (2015).] The dynamics described above are equivalent to the motion of a single elastic dumbbell under a constant external force which is parallel to a flat free surface. The dumbbell migrates away from the interface and its tumbling time increases.

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