Supplementary Information (SI) for Soft Matter.
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Supplementary Information

Oscillatory Flow Improves Hydrodynamic Ordering of Soft Suspensions in Rectangular Channels

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1. Supplementary Movie Captions

Supplementary Movie 1: Simulation of hydrodynamic ordering in a capsule suspension with Ca = 0.1, Wo = 0 (i.e., steady flow), Re = 1, ϕ = 10.66%, w/a = 5.5, and h/a = 1.5. The movie includes both top-down and side views of the suspension.

Supplementary Movie 2: Simulation of hydrodynamic ordering in a capsule suspension with Ca = 0.1, Wo = 0.194 (i.e., oscillatory flow), Re = 1, ϕ = 10.66%, w/a = 5.5, and h/a = 1.5. The movie includes both top-down and side views of the suspension.

2. Simulation Parameters

***Table S1**: simulation parameters in Lattice Boltzmann units*

Parameter	Symbol	Value
lattice spacing	Δx	1.0 (lattice units)
time step size	Δt	1.0 (lattice units)
number of lattice units in x-dir.	N_x	1000
number of lattice units in y-dir.	N_y	66 (w/a = 5.5) 88 (w/a = 7.3)
number of lattice units in z-dir.	N_z	18
number of time steps	---	2000000 (w/a = 5.5) 3000000 (w/a = 7.3)
LBM relaxation time	τ	1.0
fluid density	ρ	1.0
fluid kinematic viscosity	ν	1/6
capsule resting radius	a	6 Δx

***Table S2**: Correlation of oscillatory time periods and Wolmersley number*

Oscillation time period, T *(given in number of LBM time steps)*	**Wo** *(for 1000 x 66 x 18 lattice)*	**Wo** *(for 1000 x 88 x 18 lattice)*
3000	1.58	1.68
5000	1.23	1.30
7000	1.04	1.10
10000	0.87	0.92
15000	0.71	0.75
30000	0.50	0.53
40000	0.43	0.46
50000	0.39	0.41
100000	0.27	0.29
200000	0.19	0.21
400000	0.14	0.15
500000	0.12	0.13
1000000	0.09	0.09
2000000	0.06	0.06

3. Supplementary Figures

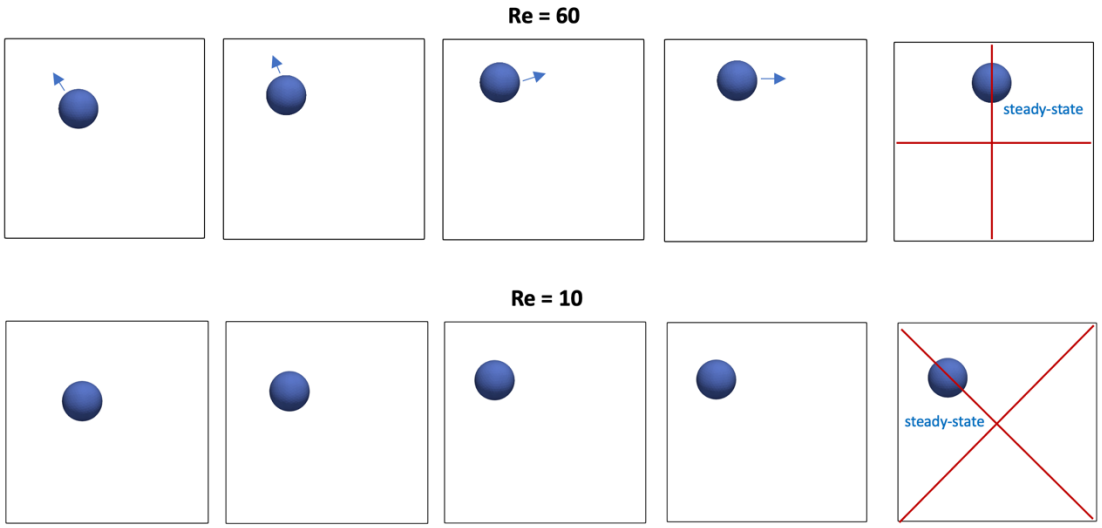

Figure S1: Snapshots of inertial lateral focusing for a single quasi-rigid particle (Ca = 0.003) in a square channel with h/a = w/a = 5.1 for: (top) Re = 60 and (bottom) Re = 10. The results show that the stable steady-state position is on main axes for Re = 60 and on the diagonal axes for Re = 10, in agreement with Schaaf and Stark [Schaaf C, Stark H. Inertial migration and axial control of deformable capsules. Soft Matter 13 (2017) 3544]. Note that S&S used Re = 100 rather than Re = 60.

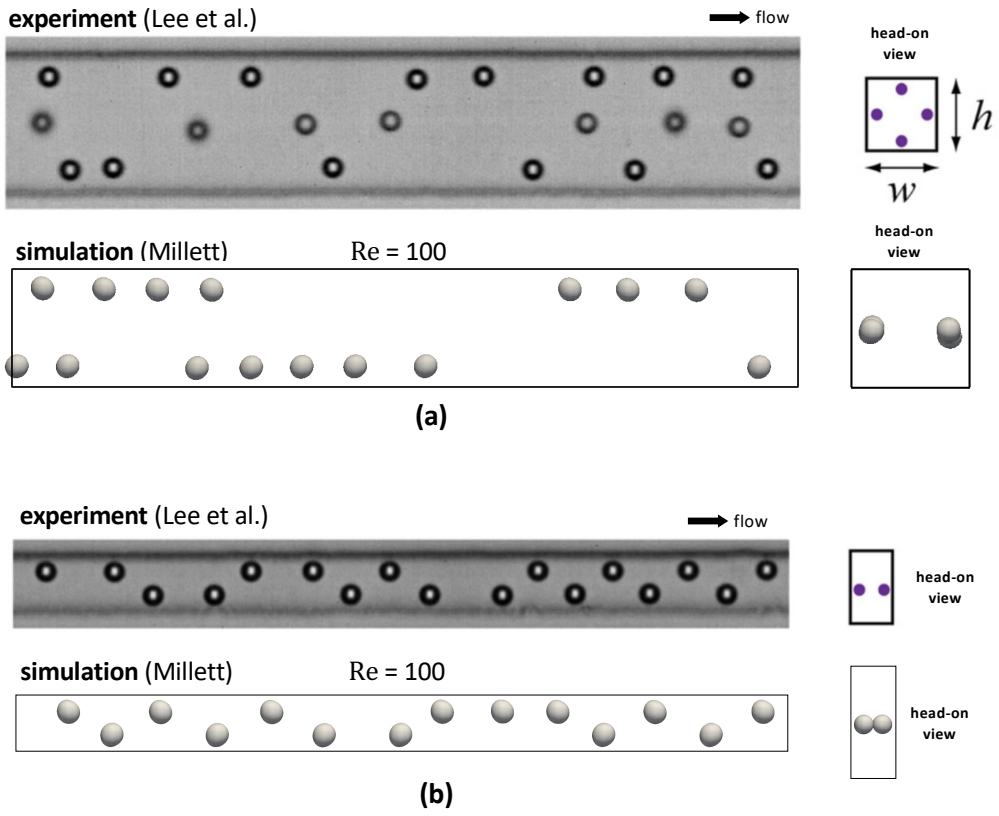

Figure S2: Comparison between experiments by Lee et al. [Lee W, Amini H, Stone HA, Di Carlo D. Dynamic self-assembly and control of microfluidic particle crystals. PNAS 107 (2010) 22413.] and simulations for rigid-particle ordering at Re = 100. The simulations used very stiff (quasi-rigid) particles with Ca = 0.003, with random initial distribution. (a) A square channel with h/a = w/a = 6.75 resulting in inertial train formations at the main axes. (b) A rectangular channel with h/a = 5.92 and w/a = 2.42 resulting in inertial trains with alternating particle distributions.