



## Supporting Information

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Visible Light Actuated Efficient Exclusion Between  
Plasmonic Ag/AgCl Micromotors and Passive Beads

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## Supporting Information

### Visible light actuated efficient exclusion between plasmonic Ag/AgCl micromotors and passive beads

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Keywords: visible light-driven micromotors, active Janus particles, passive beads, exclusion interaction

### Supporting video files

Video S1. (for Figure 4a-c) Trajectory recordings of a single Janus PS/Ag/AgCl particle surrounded by 1  $\mu\text{m}$  PS beads under green and blue light illumination.

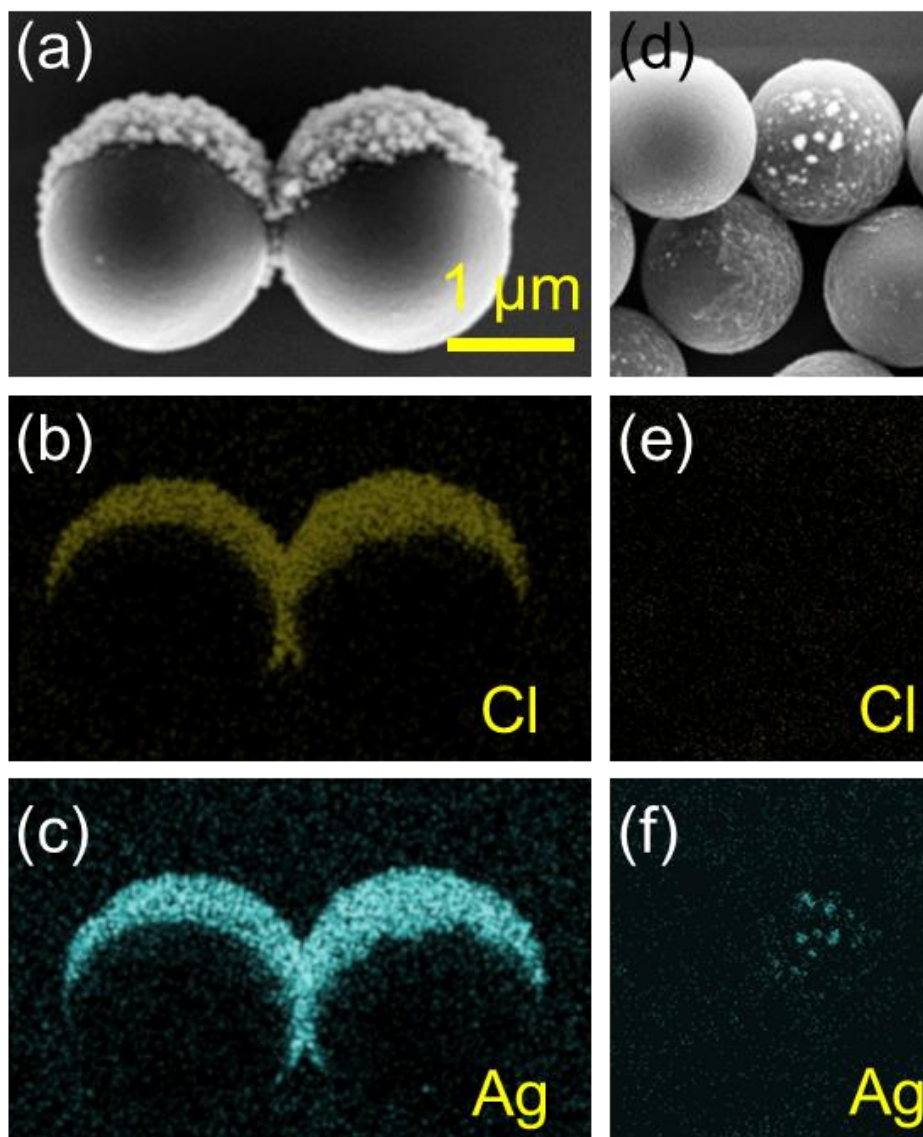
Video S2. (for Figure 4d-g) Trajectory recordings of four PS beads around a single Janus PS/Ag/AgCl micromotor under blue light illumination.

Video S3. (for Figure 3a-c) Trajectory recordings of 3-particles Janus surrounded by 1  $\mu\text{m}$  PS beads under green and blue light illumination.

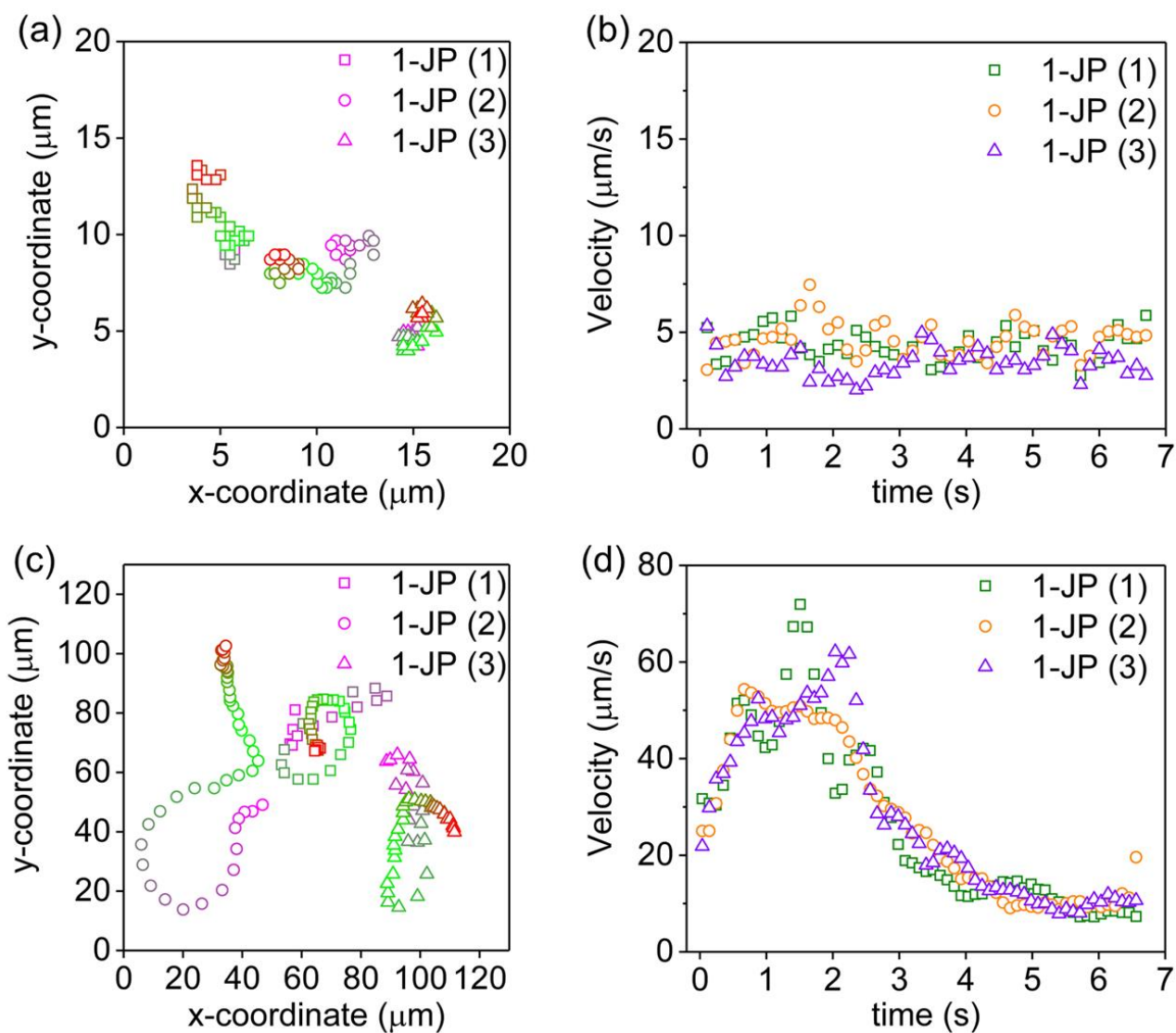
Video S4. (for Figure 3d-g) Trajectory recordings of four PS beads around a 3-particles Janus under blue light illumination.

Video S5. (for Figure 2a-c) Trajectory recordings of a Janus cluster surrounded by 1  $\mu\text{m}$  PS beads under green and blue light illumination.

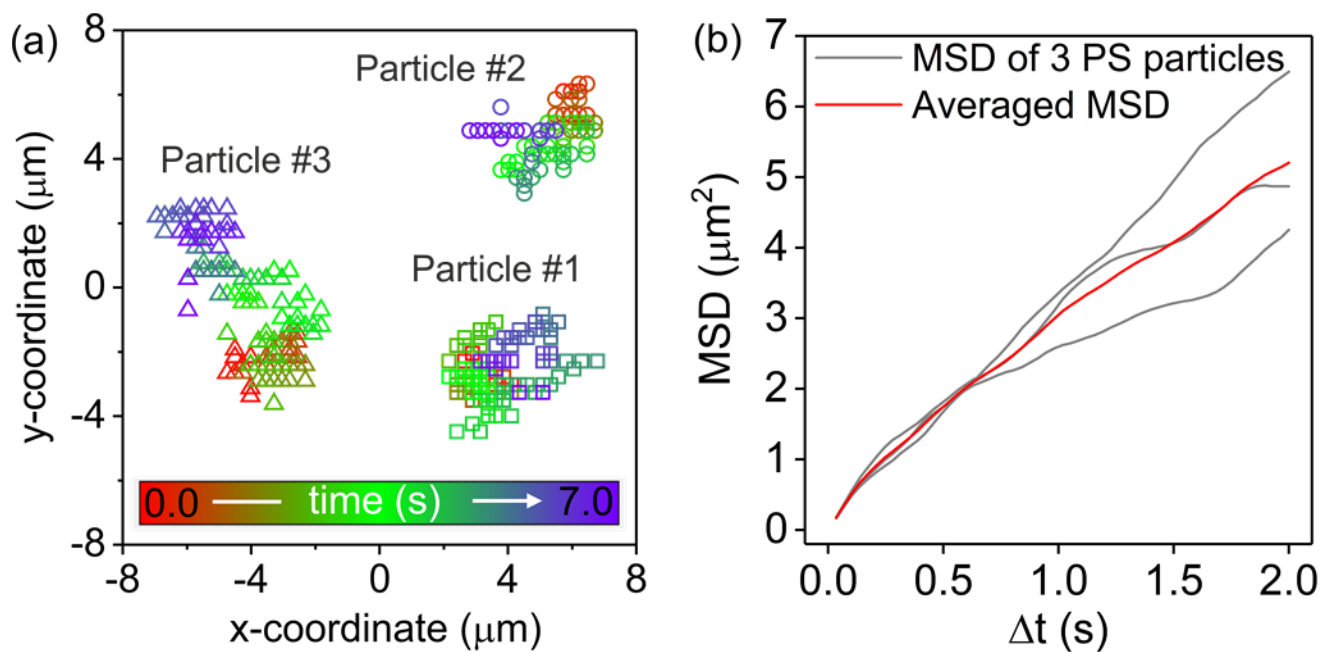
Video S6. (for Figure 2d-g) Trajectory recordings of PS beads around a Janus cluster under blue light illumination.



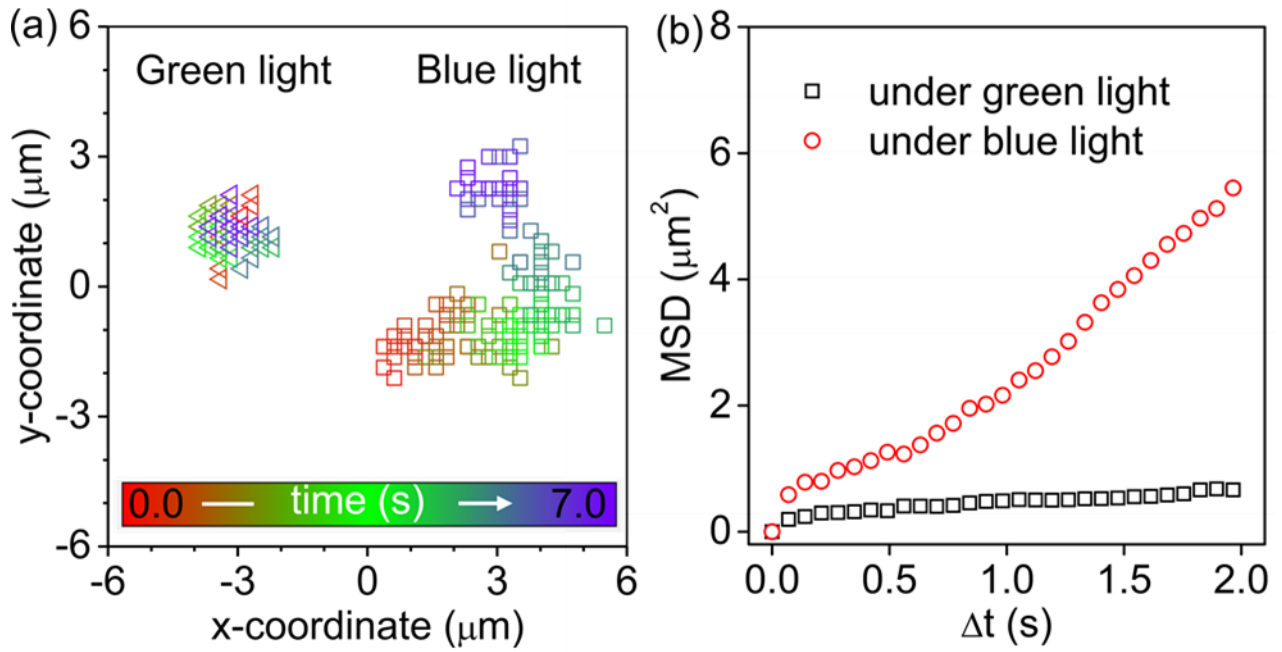
**Figure S1.** (a) SEM image of PS/Ag/AgCl Janus particles and the corresponding EDX mapping of (b) Cl and (c) Ag elements. (d) SEM image of PS/Ag/AgCl Janus particles processed in an ammonia solution and the corresponding EDX mapping of (e) Cl and (f) Ag elements.



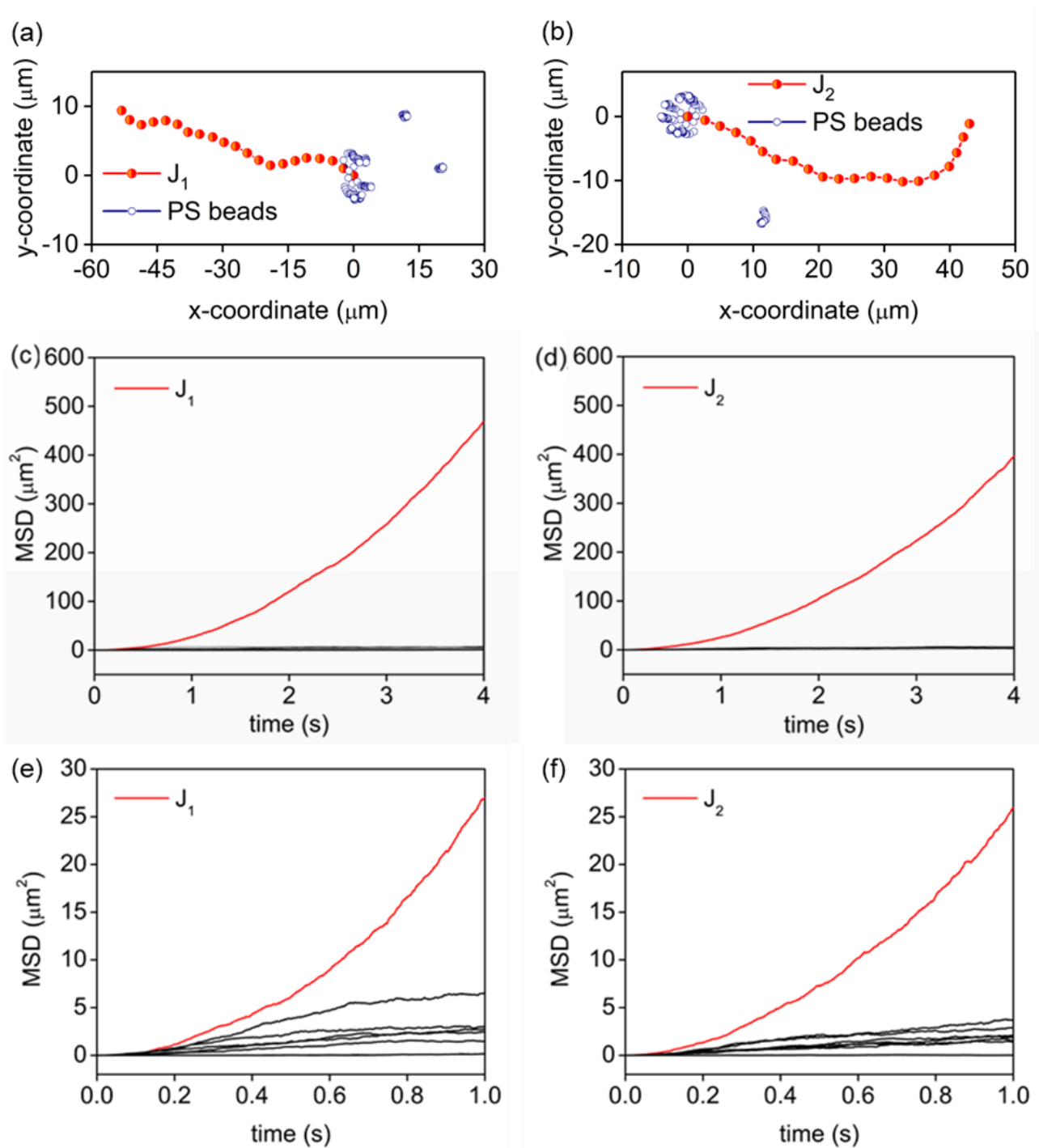
**Figure S2.** Trajectories of 3 single Janus PS/Ag/AgCl (1-JP) micromotors under (a) green light and (c) blue light illumination. The trajectories are taken over 7 s. The corresponding velocity of these Janus particles are shown in panels (b) and (d).



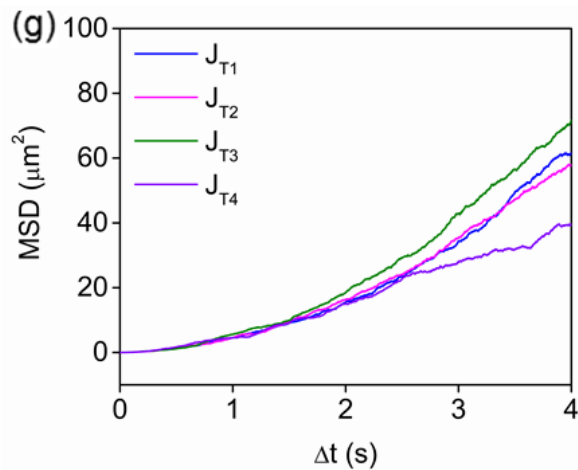
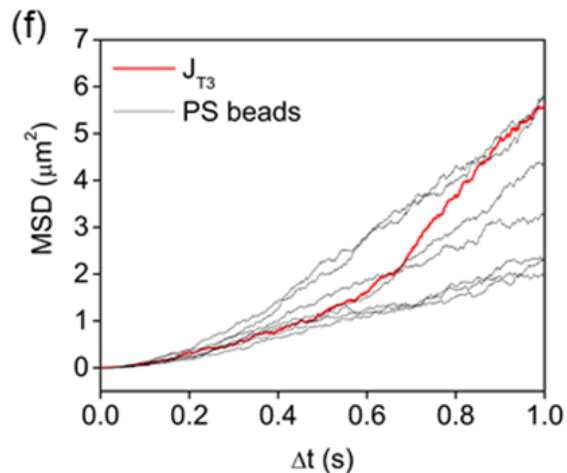
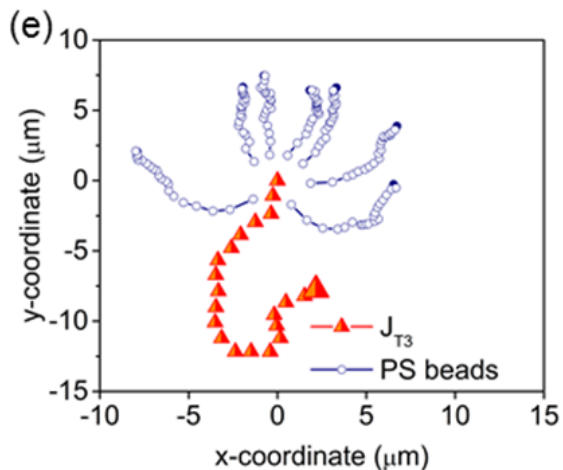
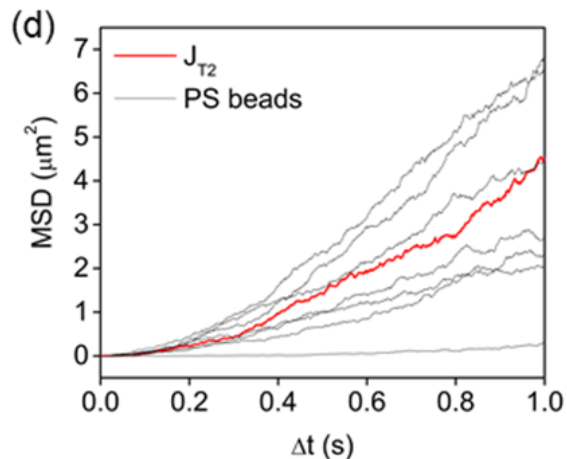
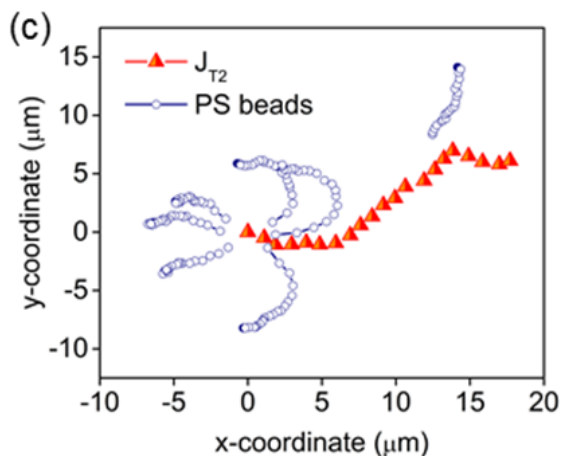
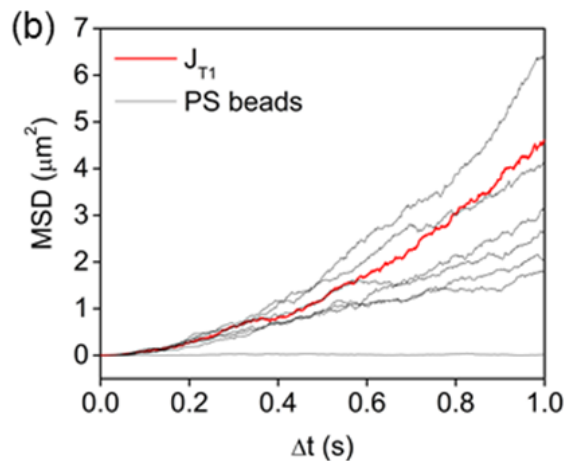
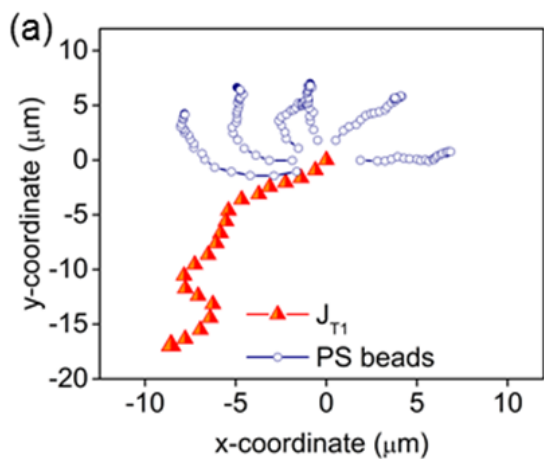
**Figure S3.** (a) Trajectories of 3 single passive Polystyrene beads (diameter: 1  $\mu\text{m}$ ) under green light illumination (intensity of the green light:  $(8 \pm 1) \mu\text{W} / \text{mm}^2$ ). The trajectories are taken over 7 s. (b) The corresponding MSD curve averaged over three particles shown in panel (a).



**Figure S4.** (a) Trajectories and (b) corresponding MSD curves of a Janus cluster under green light and blue light illumination. The trajectories are taken over 7 s. The intensity of the green light is  $(8 \pm 1) \mu\text{W}/\text{mm}^2$ . The intensity of the blue light is  $(106 \pm 1) \mu\text{W}/\text{mm}^2$ .

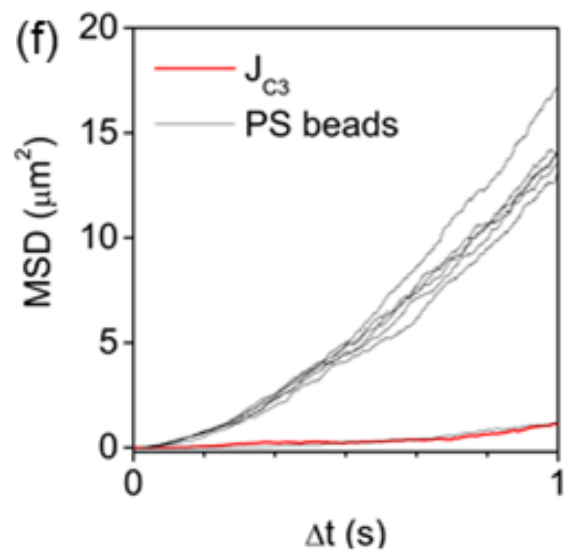
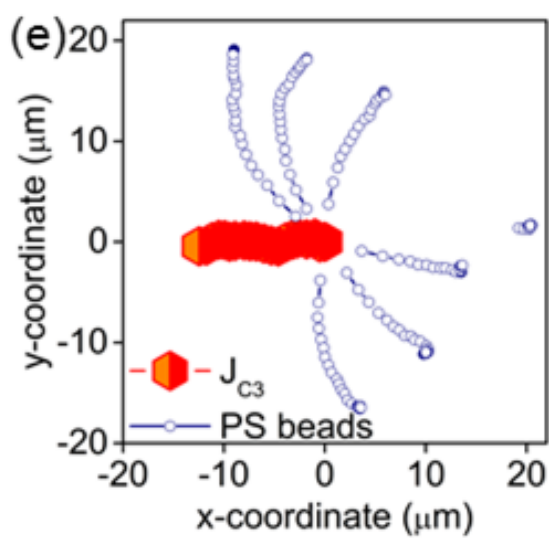
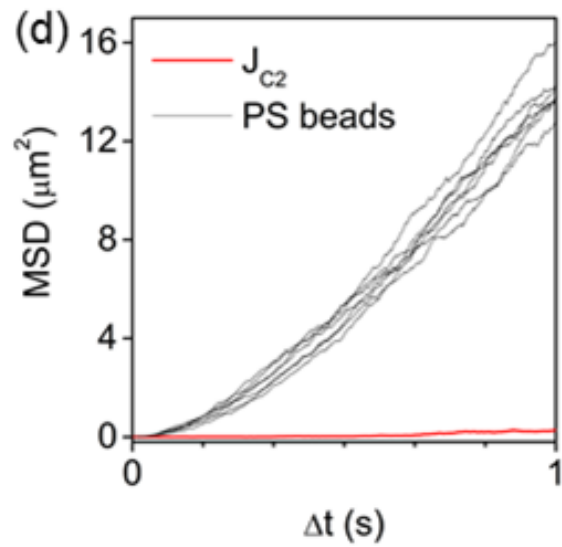
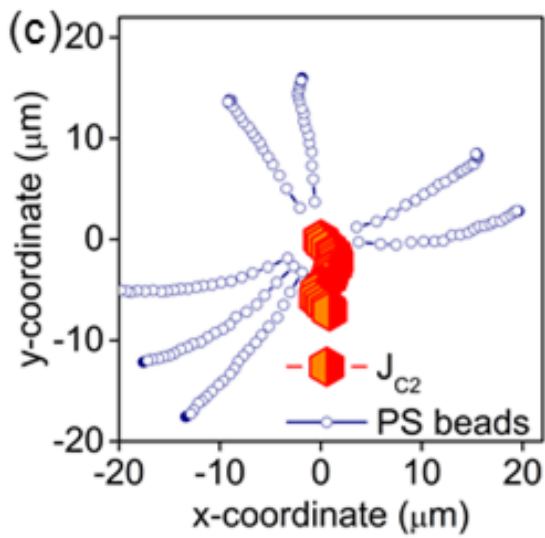
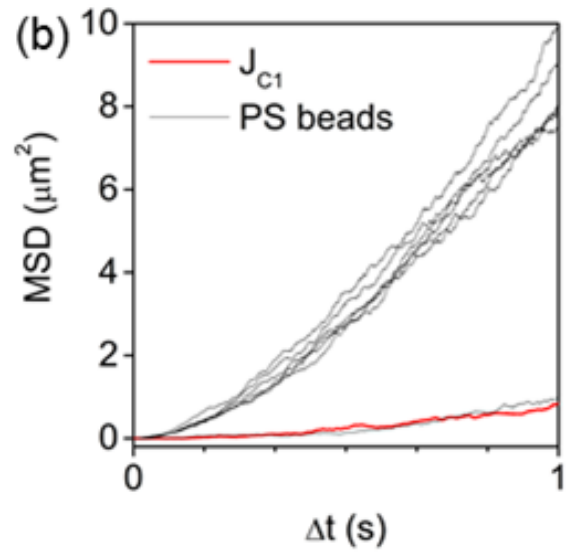
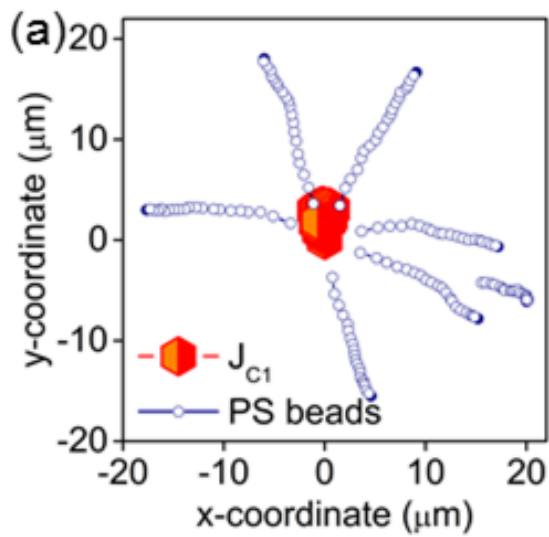


**Figure S5.** Typical simulated trajectories of two single Janus particles surrounded with PS beads during the first 10 s after turning the blue light on. The corresponding MSD curves are shown for 1 s and 4 s. Top row (a, b): simulated trajectories of two single Janus particles,  $J_1$  ( $v_0 = 5.5 \mu\text{m/s}$ ) and  $J_2$  ( $v_0 = 5.5 \mu\text{m/s}$ ), and PS beads during the first 10 s after turning the blue light on. Central row (c, d): the corresponding MSD curves (red curves: Janus particles; black curves: PS beads) for 4 s. Bottom row (e, f): MSD curves for 1 s.

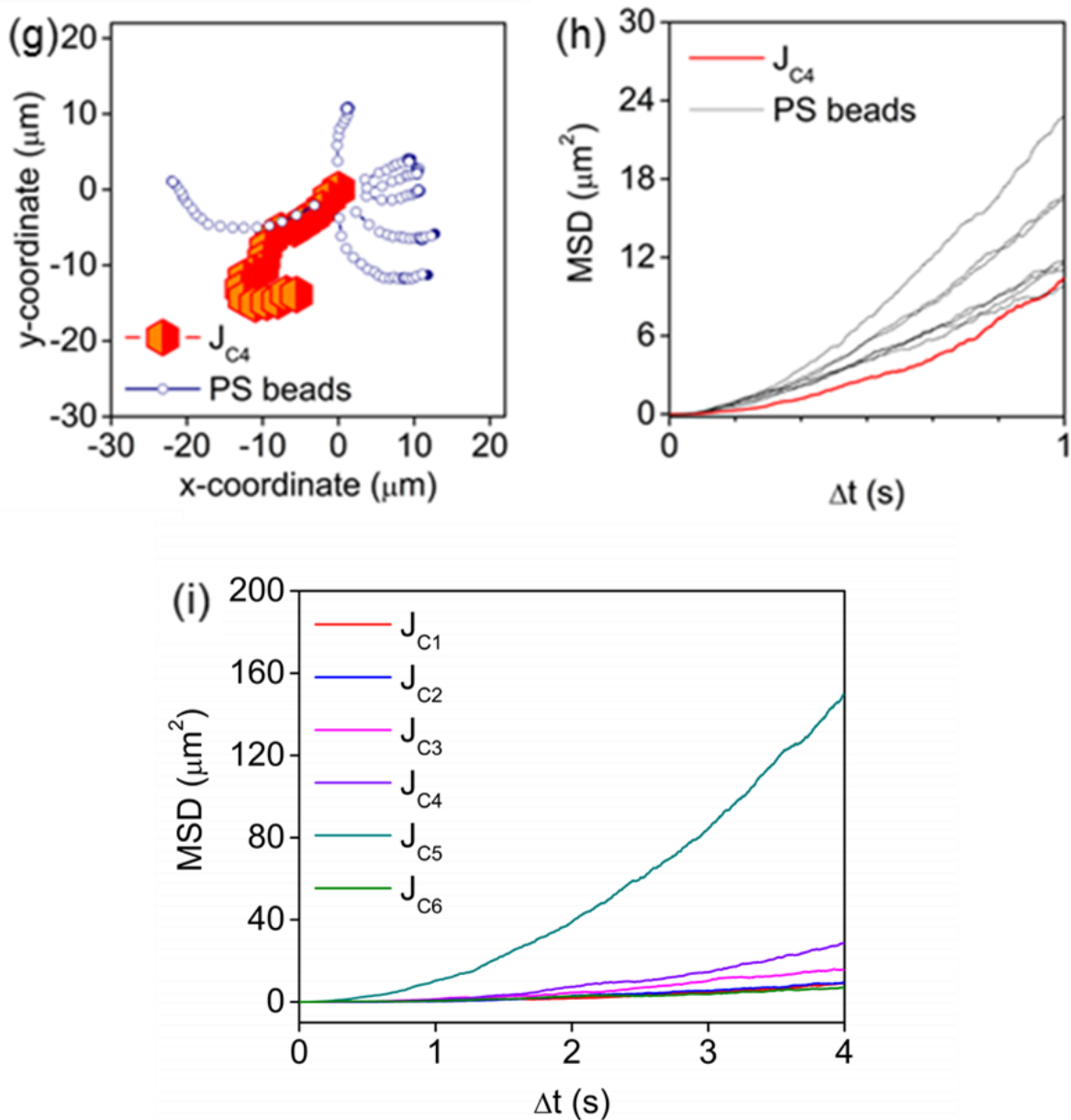




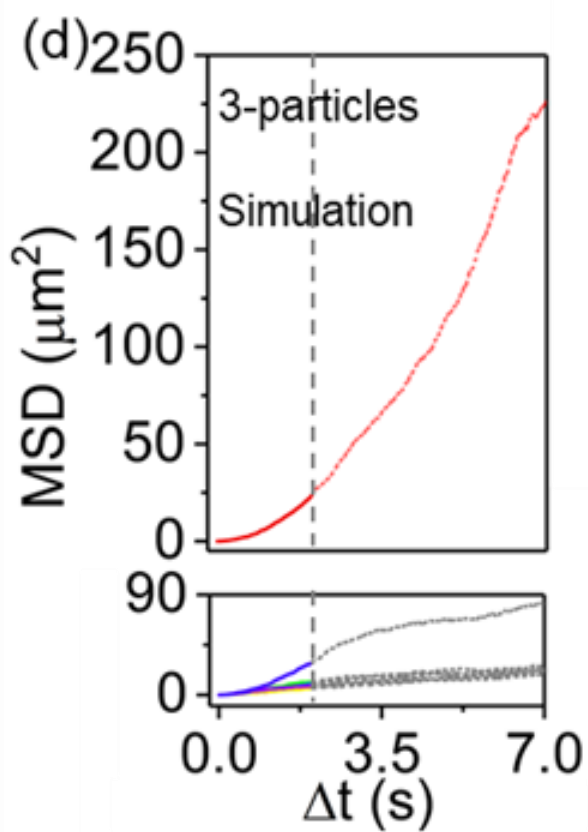
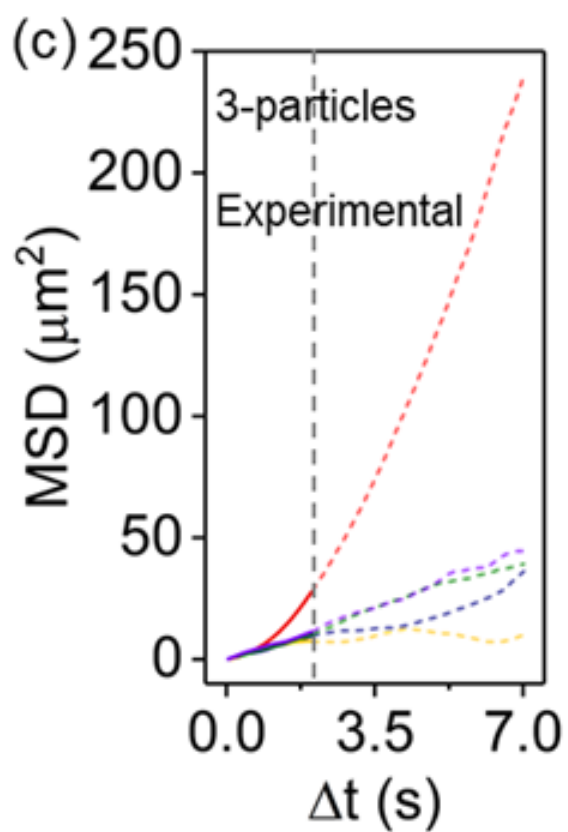
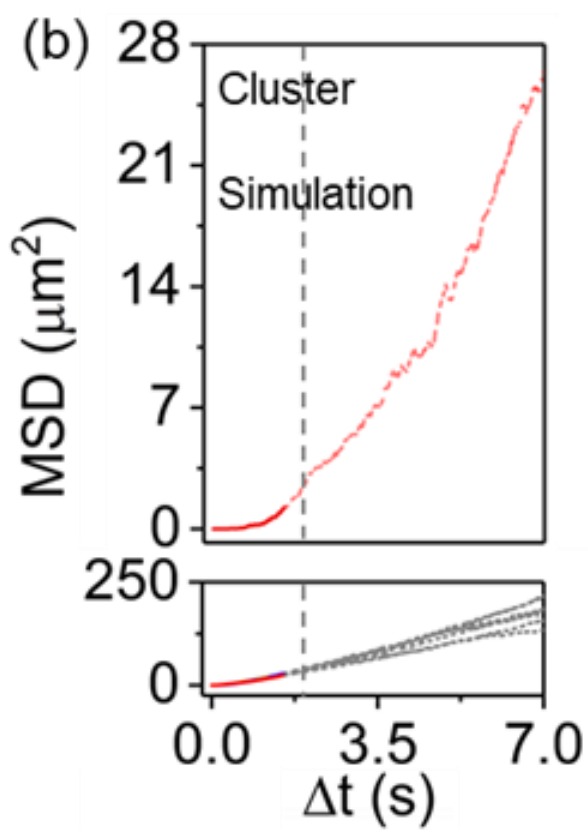
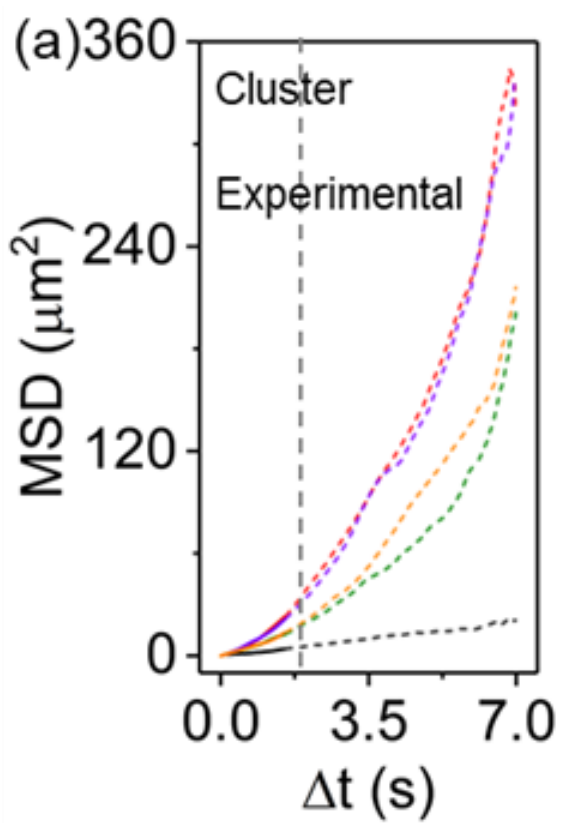
**Figure S6.** Left column (a, c, e): simulated trajectories of four triple Janus particles,  $J_1$  ( $v_0 = 2.25 \mu\text{m/s}$ ),  $J_2$  ( $v_0 = 2.25 \mu\text{m/s}$ ) and  $J_3$  ( $v_0 = 2.25 \mu\text{m/s}$ ) surrounded with PS beads during the first 10 s after turning the blue light on. Right column (b, d, f): the corresponding MSD curves (red curves: Janus particles; black curves: PS beads) for 1 s. Bottom panel (g): simulated MSD curves of four Janus particles,  $J_1$  to  $J_4$ , for 4 s.



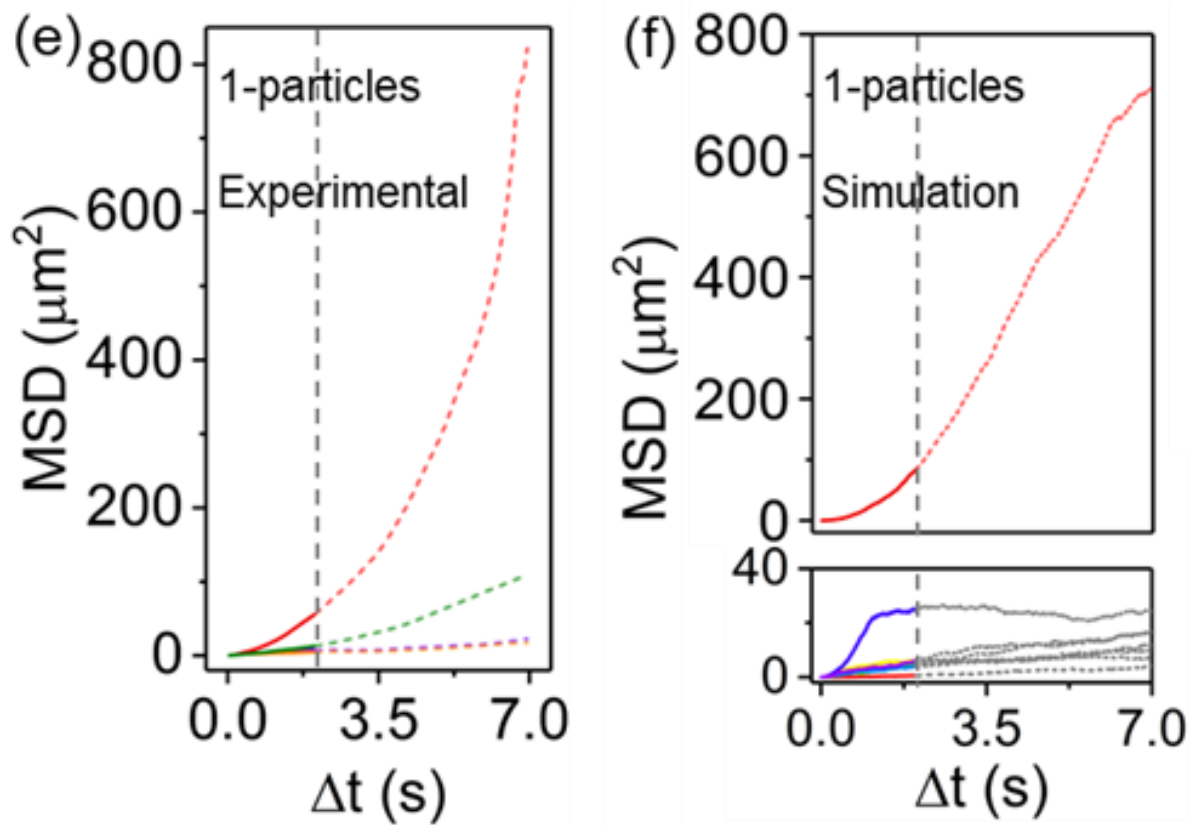
(Figure S7: continued at the next page)



**Figure S7.** Left column (a, c, e, j): simulated trajectories of five Janus clusters,  $J_1$  ( $v_0 = 0.75 \mu\text{m/s}$ ),  $J_2$  ( $v_0 = 0.75 \mu\text{m/s}$ ),  $J_3$  ( $v_0 = 1.2 \mu\text{m/s}$ ) and  $J_4$  ( $v_0 = 3.0 \mu\text{m/s}$ ) surrounded with PS beads during the first 10 s after turning the blue light on. Right column (b, d, f, h): the corresponding simulated MSD curves for 1 s; and (k) simulated MSD curves of seven Janus clusters,  $J_1$  to  $J_6$ , for 4 s.



(Figure S8: continued at the next page)



**Figure S8.** The experimental and simulated MSD curves of the micromotors and surrounding PS beads in 2 s (solid lines) and 7 s (dashed lines), respectively. (a-b) The MSD curves of the cluster and surrounding beads. The corresponding trajectories taken over 7 s are shown in Figure 2d of the main text. (c-d) The MSD curves of the 3-particles assembly and surrounding beads. The corresponding trajectories taken over 7 s are shown in Figure 3d of the main text. (e-f) The MSD curves of a single Janus particle and surrounding beads. The corresponding trajectories taken over 7 s are shown in Figure 4d of the main text.