Electronic Supplementary Information (ESI)

Yuji Sasaki,[1] Yoshinori Takikawa,[1] V. S. R. Jampani,[2] Hikaru Hoshikawa,[1] Takafumi Seto,[1] Christian Bahr,[2]* Stephan Herminghaus,[2] Yoshiki Hidaka,[3] and Hiroshi Orihara[1]*

1 Division of Applied Physics, Faculty of Engineering, Hokkaido University North 13 West 8, Kita-ku, Sapporo, Hokkaido 060-8628 (Japan)

2 Max Planck Institute for Dynamics and Self-Organization (MPIDS), 37077 Goettingen, (Germany)

3 Department of Applied Quantum Physics and Nuclear Engineering, Faculty of Engineering, Kyushu University, Fukuoka 819-0395, (Japan)

* Corresponding author: orihara@eng.hokudai.ac.jp
christian.bahr@ds.mpg.de

Figure S1

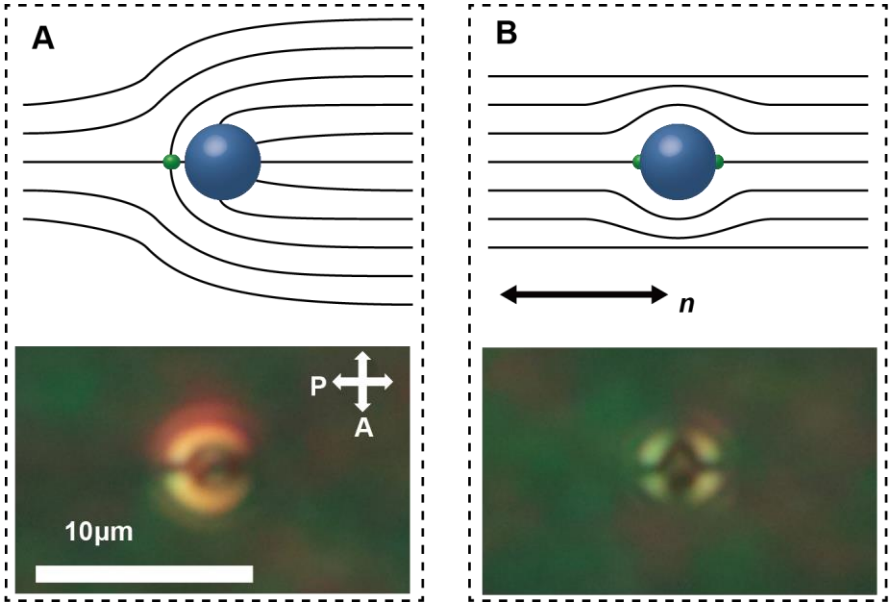

Figure S1. Schematic illustrations of the director fields around spherical particles (upper row) and the corresponding polarizing micrographs (lower row). A: Perpendicular anchoring of the nematic director, resulting in a director configuration with dipolar symmetry. B: Planar anchoring, resulting in a director configuration with quadrupolar symmetry.

Figure S2

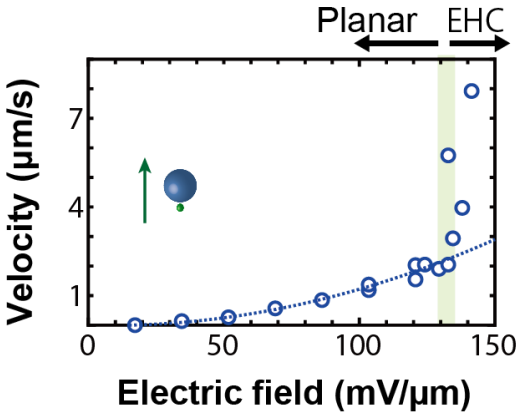

Figure S2. The velocity *v* of a single particle as a function of the amplitude of the applied AC electric field (frequency 50 Hz). At low field strengths the planar undistorted director field is retained and the pure LCEEP effect (*v* being proportional to E^2) is observed. The formation of the EHC rolls results in a sudden increase of *v*.

Figure S3

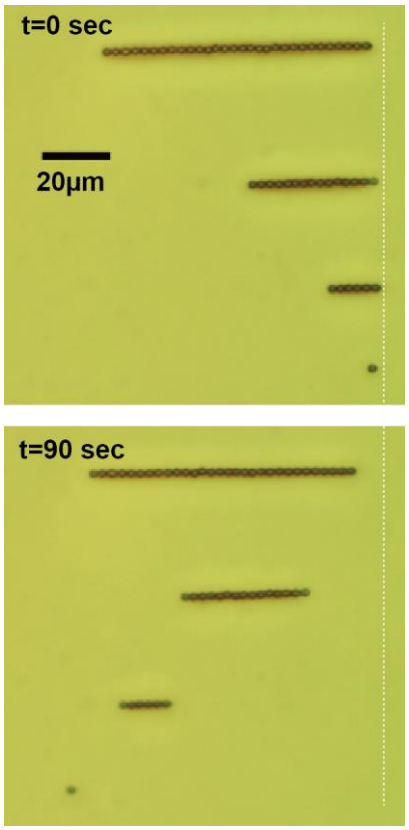

Figure S3. The figure shows simultaneously the pure LCEEP effect for a single dipolar particle and three colloidal chains with different lengths. The images are taken under plane-polarized light. The smaller units move faster than the longer ones, demonstrating that longer colloidal chains are almost immovable by the pure LCEEP effect. The corresponding velocity vs. field strength diagrams for the single particle and the longest chain (30 particles) are shown in Fig. S2 and Fig. 3C.

Movie S1

The movie shows the typical motion of a dipolar colloid hopping from one EHC roll to the next. The movie was taken under cross-polarized light. Here the frequency of the AC field is fixed at 50 Hz and the applied electric field is adjusted to have a stationary pattern.

Movie S2

The movie shows the typical motion of a boojum colloid (planar anchoring) in both directions in EHC rolls. The movie was taken under cross-polarized light. The particle moves to the right side and comes back to almost the original position. The applied frequency is 330 Hz and the applied electric field is adjusted to have a stationary pattern.

Movie S3

The movie shows the caterpillar-like motion of a colloidal chain consisting of 30 dipolar particles in EHC rolls. The applied frequency is set to 50 Hz and the applied electric field is adjusted to have a stationary EHC pattern.

Movie S4

The movie shows the transport of a glass rod that is attached to two colloidal caterpillars. The surface of the glass rod particle has been treated for perpendicular anchoring. Note that the rod particle cannot be transported as an isolated unit by the EHC rolls.

Movie S5

The movie shows the transport of a silicon oil droplet (perpendicular anchoring) attached to one colloidal caterpillar. The diameter of the droplet is around 12 μm. Note that the oil droplet cannot be transported as an isolated unit by the EHC rolls.