Electronic Supplemental Information (ESI)

Reversible Long-Range Patterning of Gold Nanoparticles by Smectic Liquid Crystals

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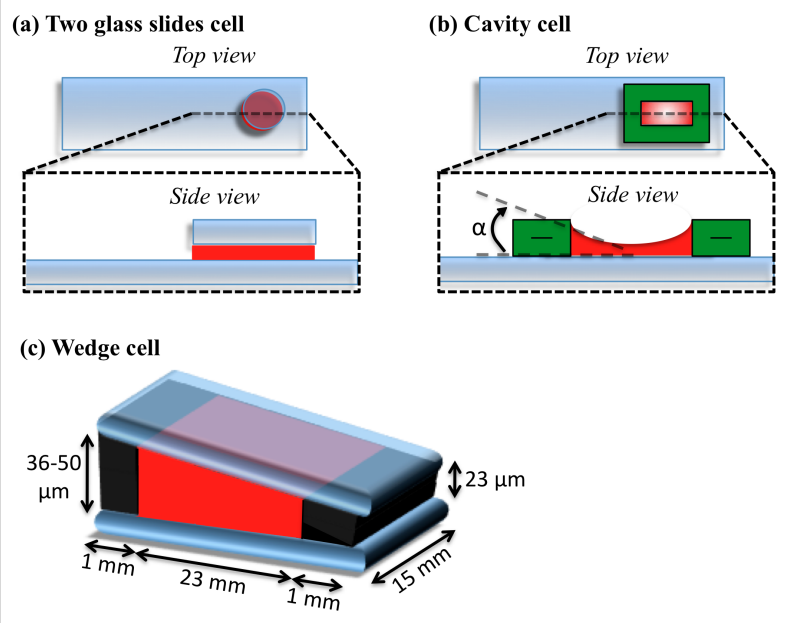
Videos

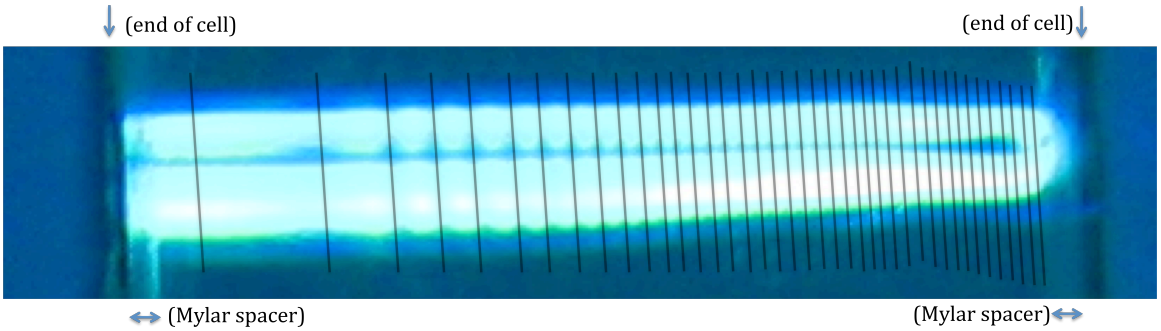
Videos of the redispersal of the gold nanoparticles at $T_{N\text{-}SmA}$ and $T_{N\text{-}I}$ with heating are included in the Electronic Supporting Information.

Liquid crystal cells

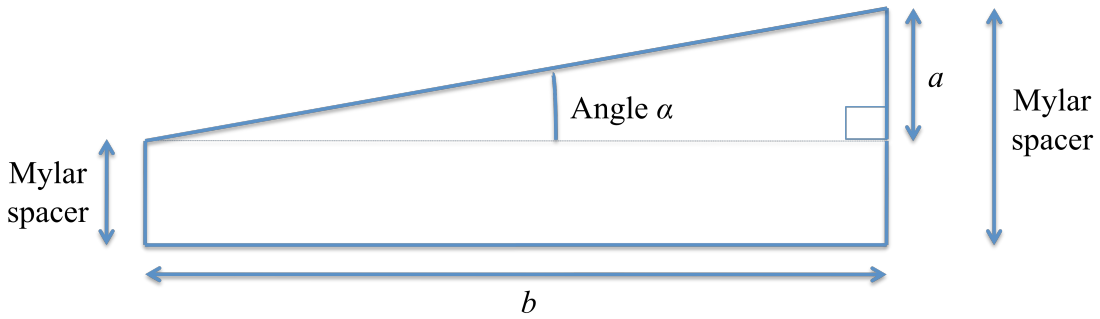


Scheme S1 Two glass slides cell (a), cavity cell (b) and wedge cell (c) were used to analyze the AuNP-liquid crystal dispersions by optical microscopy. (Color code: blue = glass, red = AuNP-liquid crystal dispersion, green = cavity wall, black = spacer)

Wedge cell characterization



Scheme S2a Micrograph of the diffraction pattern of light from a mercury pencil lamp at the surface of an empty wedged cell with Mylar spacers at each extremity.



Scheme S2b Wedge cell geometry.

Table S1 Wedge cell analysis via mercury pencil lamp.

Hg light diffraction	Wedge cell geometry		
	a	***b***	***α***
(line)	**(um)**	**(um)**	**(mrad)**
44	11.880	2.30E+04	0.52
42	11.340	2.30E+04	0.49
41	11.070	2.30E+04	0.48
		Average	0.50
		Error	0.02

Optical microscopy

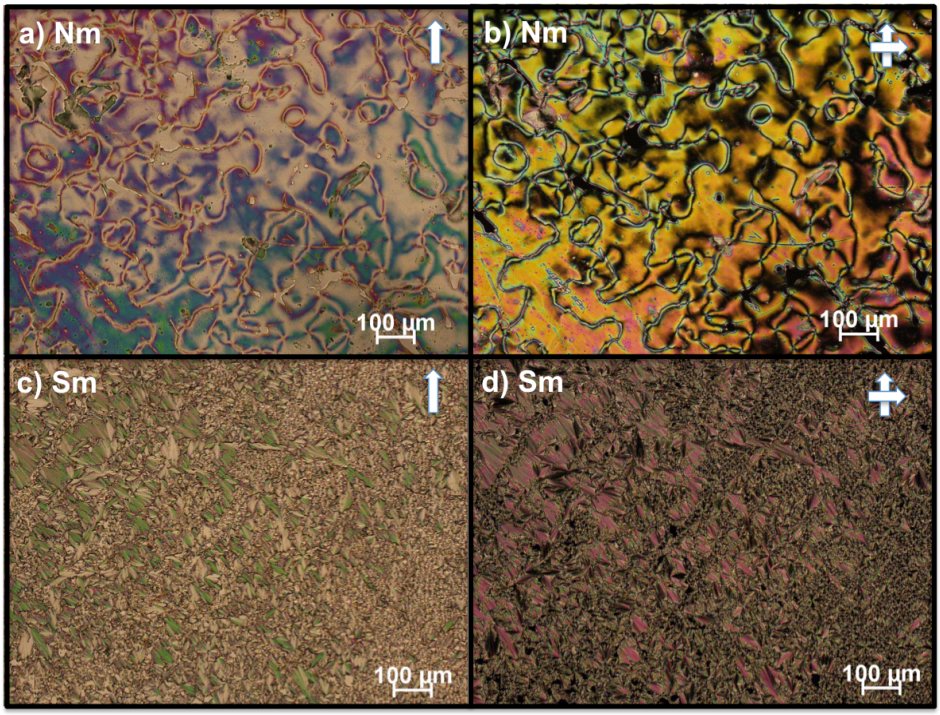


Figure S1. Polarized Optical Microscopy pictures of 8CB between untreated glass slides in the nematic (a, b) and smectic (c, d) phases.

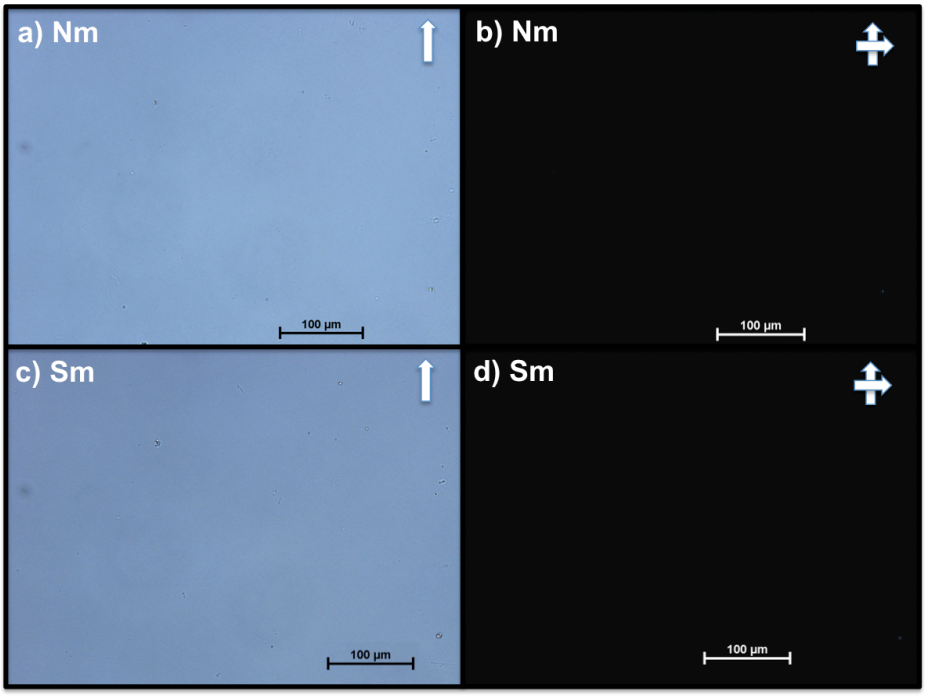


Figure S2. Polarized Optical Microscopy pictures of 8CB between homeotropic alignment slides in the nematic (a, b) and smectic (c, d) phases.

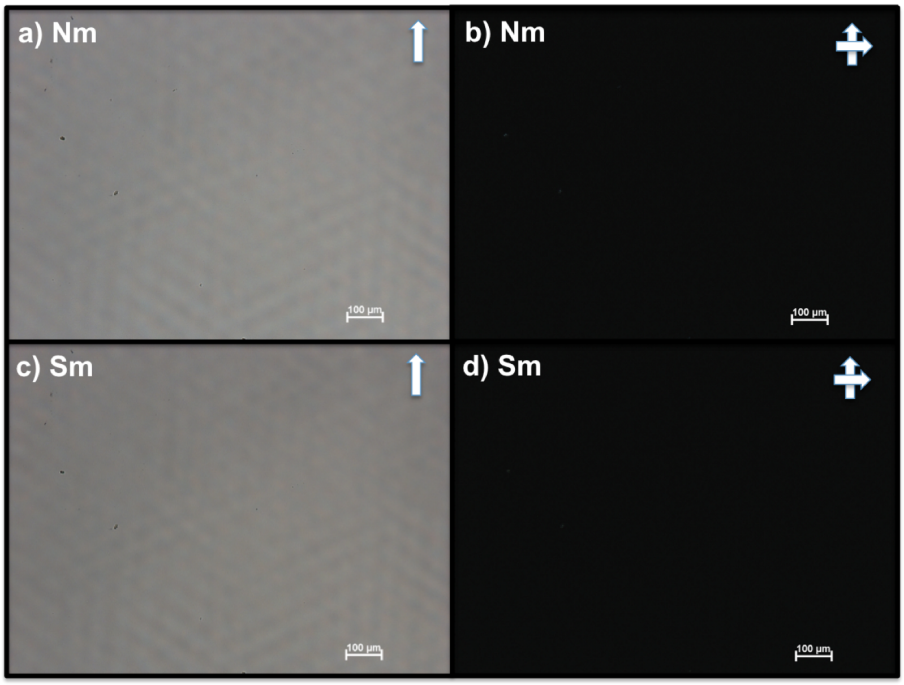


Figure S3. Polarized Optical Microscopy pictures of 8CB in a cavity cell with a homeotropic bottom slide in the nematic (a, b) and smectic (c, d) phases. The area shown is of the center of the cell.

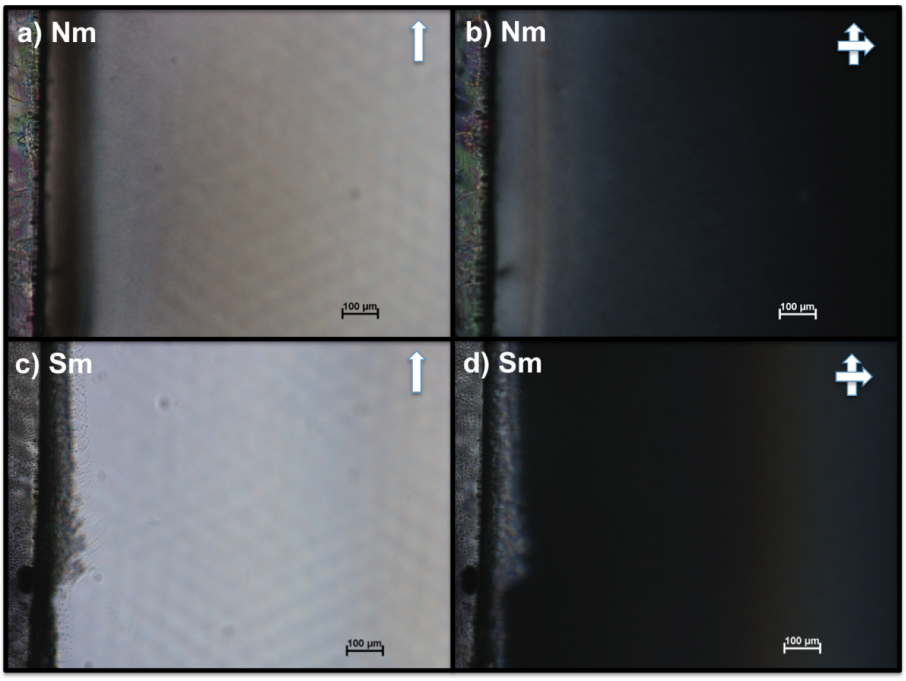


Figure S4. Polarized Optical Microscopy pictures of 8CB in a cavity cell with a homeotropic bottom slide in the nematic (a, b) and smectic (c, d) phases. The area shown is at the edge of the cell.

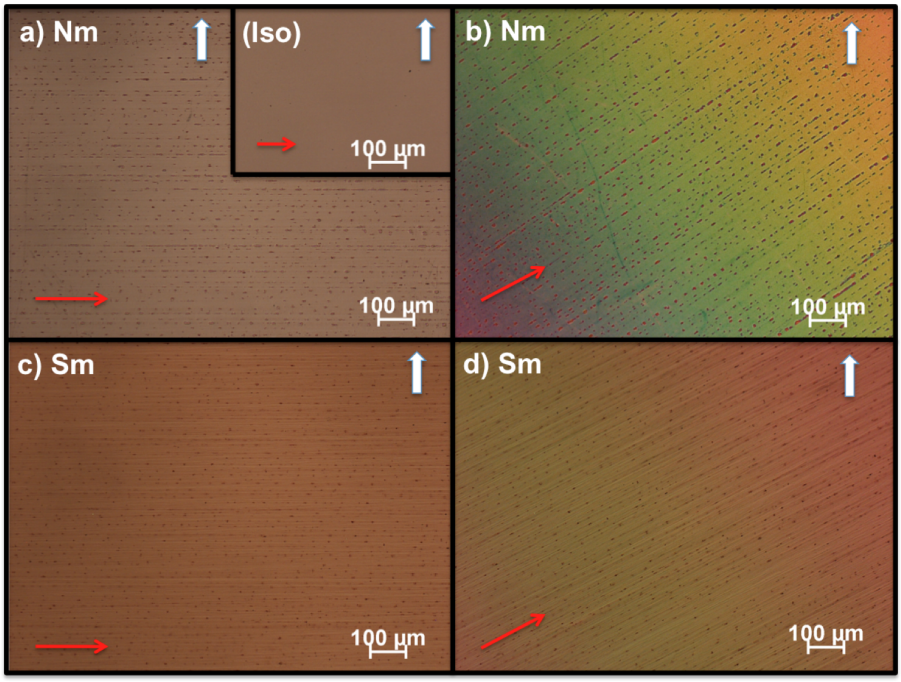


Figure S5 1.0 wt% Au AuNP dispersion between homogeneous glass slides and parallel polars (cooling rate: 1.0 °/min; red arrows: brushing direction). (a) Inset: isotropic, nematic with (a) parallel and (b) 45˚ angle brushing direction, smectic phase with (c) parallel and (d) 45° angle brushing direction.

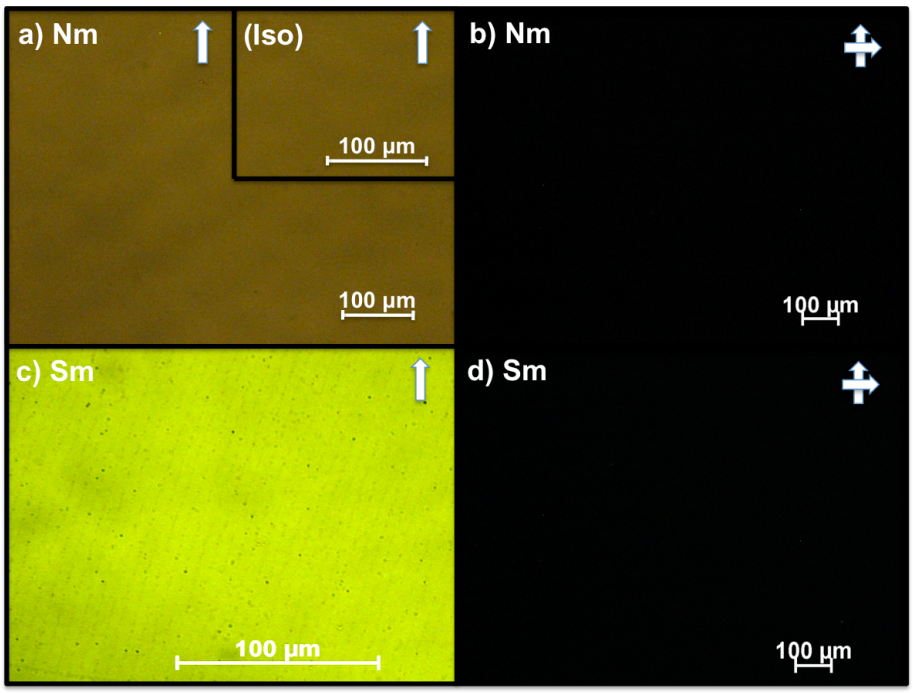


Figure S6 0.1 wt% Au AuNP dispersion between homeotropic glass slides (cooling rate: 1.0 °/min). (a) Inset: isotropic phase with parallel polars, nematic phase with (a) parallel and (b) perpendicular polars and smectic phase with (c) parallel and (d) perpendicular polars.

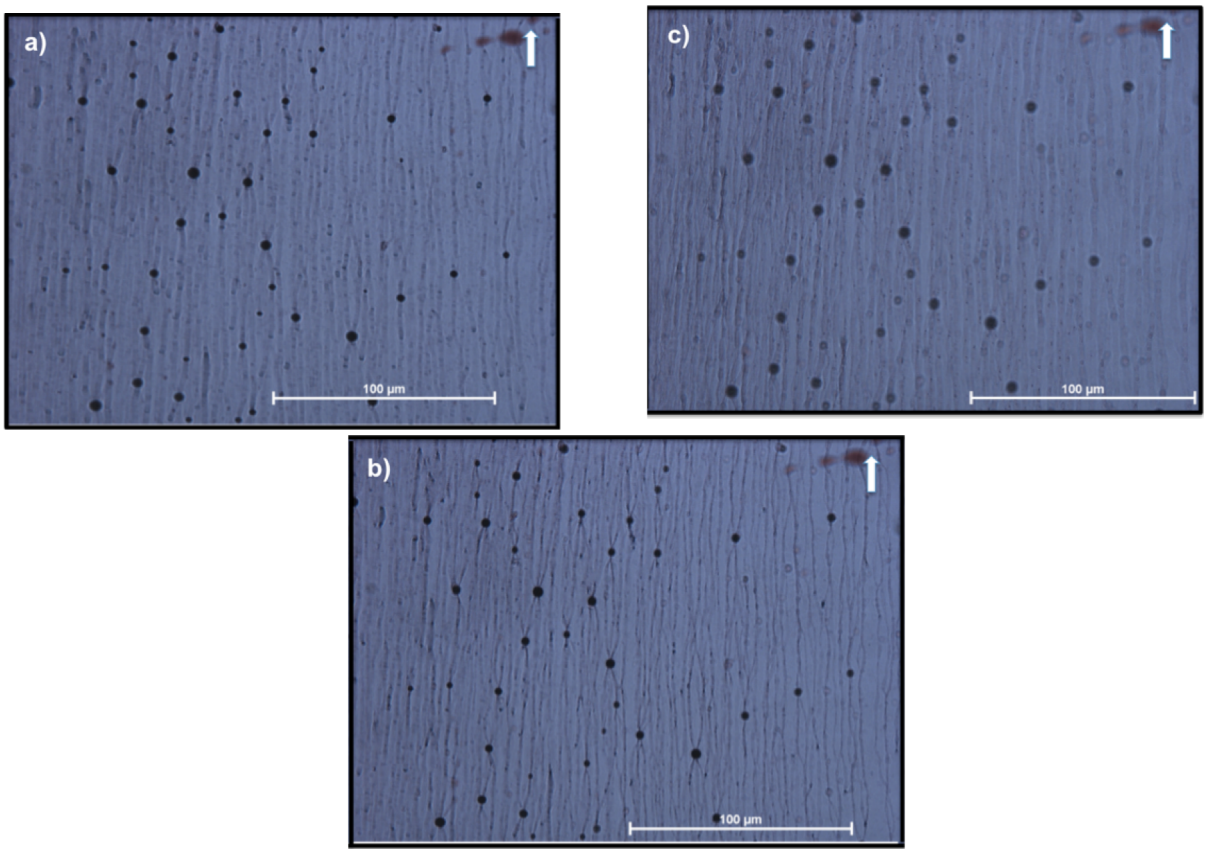


Figure S7 0.5 wt% Au AuNP dispersion in a cavity cell with a homeotropic bottom slide in the smectic phase with the focus on the (a) bottom, (b) middle and (c) top of the film. The edge dislocation lines decorated with AuNPs are in focus in (b) where the focus is on the middle of the film. Note the pinning of the line defects to the large circular AuNP aggregates that first appear in the nematic phase. These images were taken after a second heating/cooling cycle.

Image analyses of the meniscus AuNP arrays

To determine the periodicity of the AuNP arrays and how it varies with distance from the meniscus centre, we performed 15 image analyses of various micrographs. The periodicity was averaged over 8 consecutive lines of AuNP aggregates in the directions parallel and perpendicular to the cell long axis. The wave vector of the distribution q, defined as 2π over the periodicity, as the angle in a wedge cell is directly proportional to it, is given in Figure 5 of the main text. The distance from the meniscus centre is defined as the distance from the mean position of consecutive lines of AuNP aggregates to the meniscus centre. This point was chosen arbitrarily and may be closer to the real meniscus centre in the perpendicular direction than in the parallel one. In both directions, the periodicity and mean distance from the meniscus centre were averaged over 5 parallel lines, each covering 8 x 5 AuNP arrays. An example of a 8 x 5 AuNP array is given below.

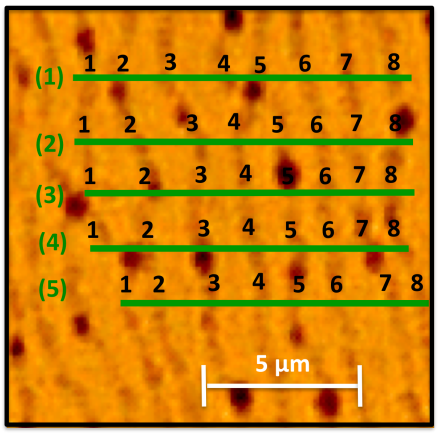
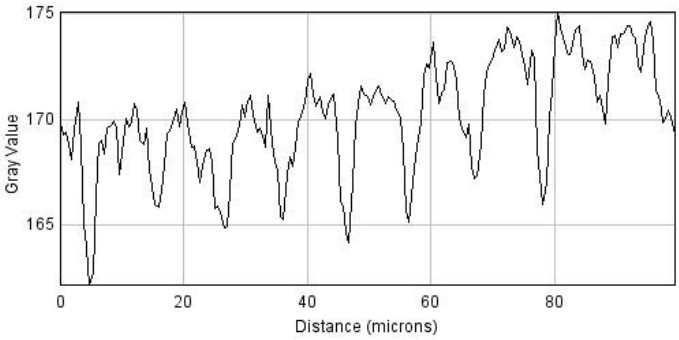


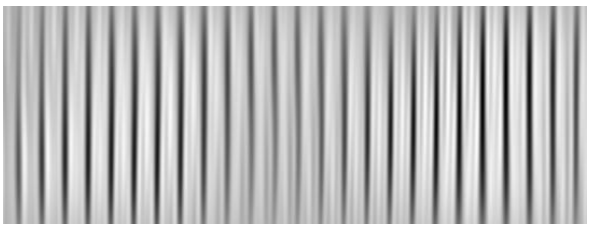
Figure S8 An expansion of the POM Figure 4b showing a 8 x 5 array of lines of AuNP aggregates.

Image analyses of the wedge cell AuNP arrays

(a)



(b)



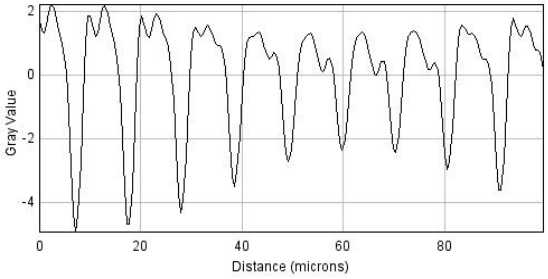


Figure S9 FFT image analysis of POM of the wedge cell with $\alpha = 0.5$ mrad shown in Fig. 6a. (a) In the FFT there is one main peak at 10.3 µm with two much less intense peaks at 5.2 and 3.4 µm due to the grainy character of the lines that decorate the main 10.3 µm frequency. (b) An inverse FFT and its cross section produced by just selecting these 3 frequencies confirms that there is mainly one periodicity of 10.3 µm.