

## Captions of Supplementary Movies

**Supplementary Movie 1. (i)** Bowser to Dowser transition of nematic 5CB flow in a H-SAM modified microchannel. The inner surfaces of a straight channel were functionalized by the H-SAM solution. Thus, homeotropic anchoring of LC was present homogeneously along the channel. The flow within the microchannel is directed from left to right. Before the movie recording, the inlet pressure of nematic 5CB flow was gradually increased from 0 to 100 mbar. The inlet pressure of 5CB was kept at 100 mbar throughout the movie, corresponding to the Bowser-to-Dowser transition point. **(ii)** Dowser to Bowser transition of nematic 5CB flow in a H-SAM modified microchannel. The inner surfaces of a straight channel were functionalized by H-SAM, so homeotropic anchoring of nematic 5CB was maintained homogeneously along the channel. The flow within the microchannel is directed from left to right. The inlet pressure of nematic 5CB flow was gradually increased from 100 to 40 mbar before the movie recording. The inlet pressure of 5CB was kept at 40 mbar throughout the movie, corresponding to the Dowser-to-Bowser transition. The video was collected under a polarized optical microscope with a polarizer and an analyzer oriented at  $135^\circ$  and  $45^\circ$ , respectively. Scale bar: 100  $\mu\text{m}$

**Supplementary Movie 2.** Nematic 5CB flow structuring with ramping up the inlet pressure in a transverse patterned H-SAM modified microchannel. Firstly, the inner surfaces of a straight channel were functionalized with the H-SAM solution. After that, the channel was UV patterned through the rectangular-shaped photomask shown in Fig. S8 for 1 hour to obtain a transverse patterned model. The movie was recorded while the inlet pressure of nematic 5CB flow was gradually increased from 0 to 100 mbar. Under these conditions, the formation of Dowser “paths” within the Bowser regions was observed, and their expansion is evident in the movie. The video was collected under a polarized optical microscope with a polarizer and an analyzer oriented at  $135^\circ$  and  $45^\circ$ , respectively. Scale bar: 100  $\mu\text{m}$

**Supplementary Movie 3.** Dowser state formation in nematic 5CB flow with ramping up the inlet pressure in a square-patterned H-SAM modified microchannel. Firstly, the inner surfaces of a straight channel were functionalized with the H-SAM solution. After that, the channel was UV patterned through the square-shaped photomask given in Fig. S8 for 1 hour to obtain a square-patterned model. Before the movie recording, the inlet pressure of nematic 5CB flow was gradually increased from 0 to 33 mbar. The inlet pressure of 5CB was kept at 33 mbar throughout the movie, corresponding to the Bowser-to-Dowser transition. Under these conditions, the formation of the Dowser state was observed, and its expansion is captured in the movie. The video was collected under a polarized optical microscope with a polarizer and an analyzer oriented at  $135^\circ$  and  $45^\circ$ , respectively. Scale bar: 100  $\mu\text{m}$

**Supplementary Movie 4.** Nematic 5CB flow structuring with ramping up the inlet pressure in a longitudinal patterned H-SAM modified microchannel. First, the inner surfaces of a straight microchannel were functionalized with the H-SAM solution. Subsequently, the channel was UV-patterned through the rectangular photomask shown in Fig. S8, which was reoriented by  $90^\circ$ , for 1 hour to obtain the patterned model. The movie was recorded while the inlet pressure of nematic 5CB flow was gradually increased from 0 to 100 mbar. Under these conditions, the growth of the Dowser paths in Bowser regions was observed, and their complete expansion was captured during the movie. The movie was accelerated threefold. The video was collected under a polarized optical microscope with a polarizer and an analyzer oriented at  $135^\circ$  and  $45^\circ$ , respectively. Scale bar: 100  $\mu\text{m}$

**Supplementary Movie 5.** Persistence of Dowser state in nematic 5CB flow during inlet-pressure ramp-down in a square-patterned H-SAM-modified microchannel. The inner surfaces of a straight microchannel were functionalized with the H-SAM solution. Subsequently, the channel was UV-patterned through the square photomask shown in Fig. S8 for 1 hour to obtain the patterned model. Before the movie recording, the inlet pressure of nematic 5CB flow was gradually increased from 100 to 40 mbar. The inlet pressure of 5CB was maintained at 40 mbar throughout the movie, corresponding to the Dowser-to-Bowser transition. The trapping of the Dowser state between square-patterned regions was recorded in the movie. The video was collected under a polarized optical microscope with a polarizer and an analyzer oriented at  $135^\circ$  and  $45^\circ$ , respectively. Scale bar: 100  $\mu\text{m}$