Dynamical cross correlation in chiral liquid crystals

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Because of the broken mirror symmetry, chiral liquid crystals often exhibit unusual dynamic structures including unidirectional molecular motions driven by transport currents. As a typical example of the dynamical cross-correlation in chiral system, we investigated the orientational and hydrodynamic molecular motions in smectic C* films induced by transmembrane gas flow[1,2]. Depending on the parameters such as flow rate of the transferred gas, Frank elastic constant of the LC materials, size of the sample and the cross-coupling constant, the velocity fields could be almost uniquely determined. The experimental result is well described by the simple analysis based on Leslie's theory, which suggests that we can manipulate the molecular motions by simply changing these parameters. We also studied the unidirectional motion of bulk cholesterics driven by thermal flow, which was first found by O. Lehmann more than a century ago. We observed both the self-rotation of the cholesteric droplets and the director unidirectional rotation under a hear current, where the rotational direction is inversed by reversing either the molecular chirality or the direction of the heat transport. As is the case with the SmC* films, the two motions could be switched to each other by changing the parameters, mainly the anchoring condition.

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2. K. Seki, K. Ueda, Y. Okumura, Y. Tabe, *J. Phys.:Condens matt.* **23**, 284114 (2011).