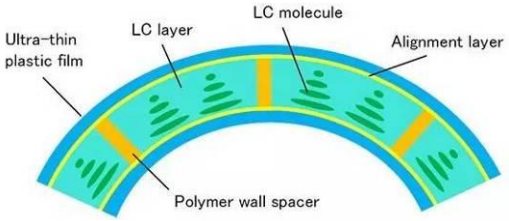
# 多物理场激励响应软机器人

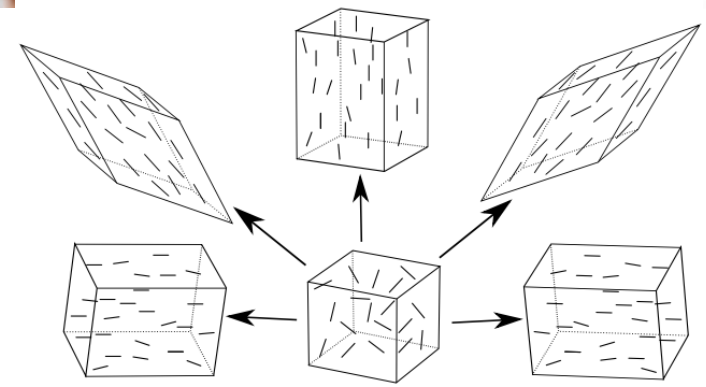
Chen Xuan

Xi’an Jiaotong Liverpool University

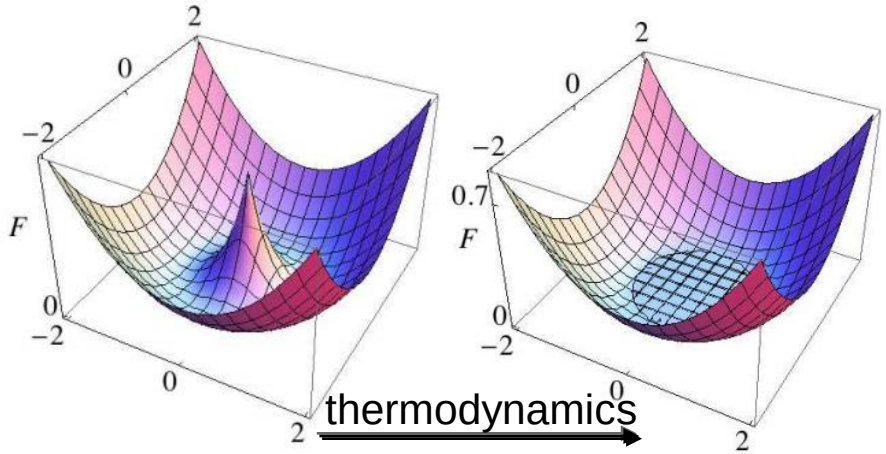
2024-10

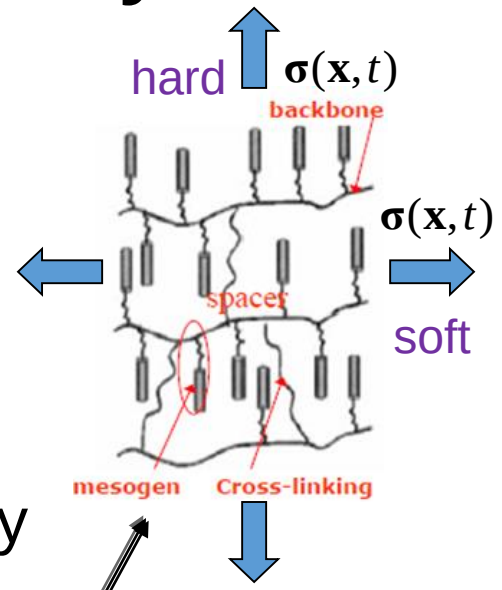
# LC elastomers: infinite well system

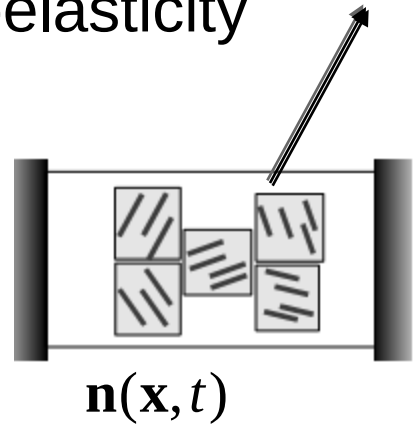


- instability, fine textures
- viscoelasticity

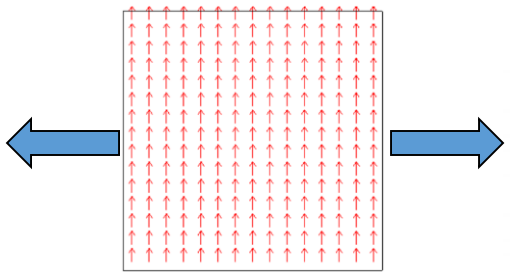


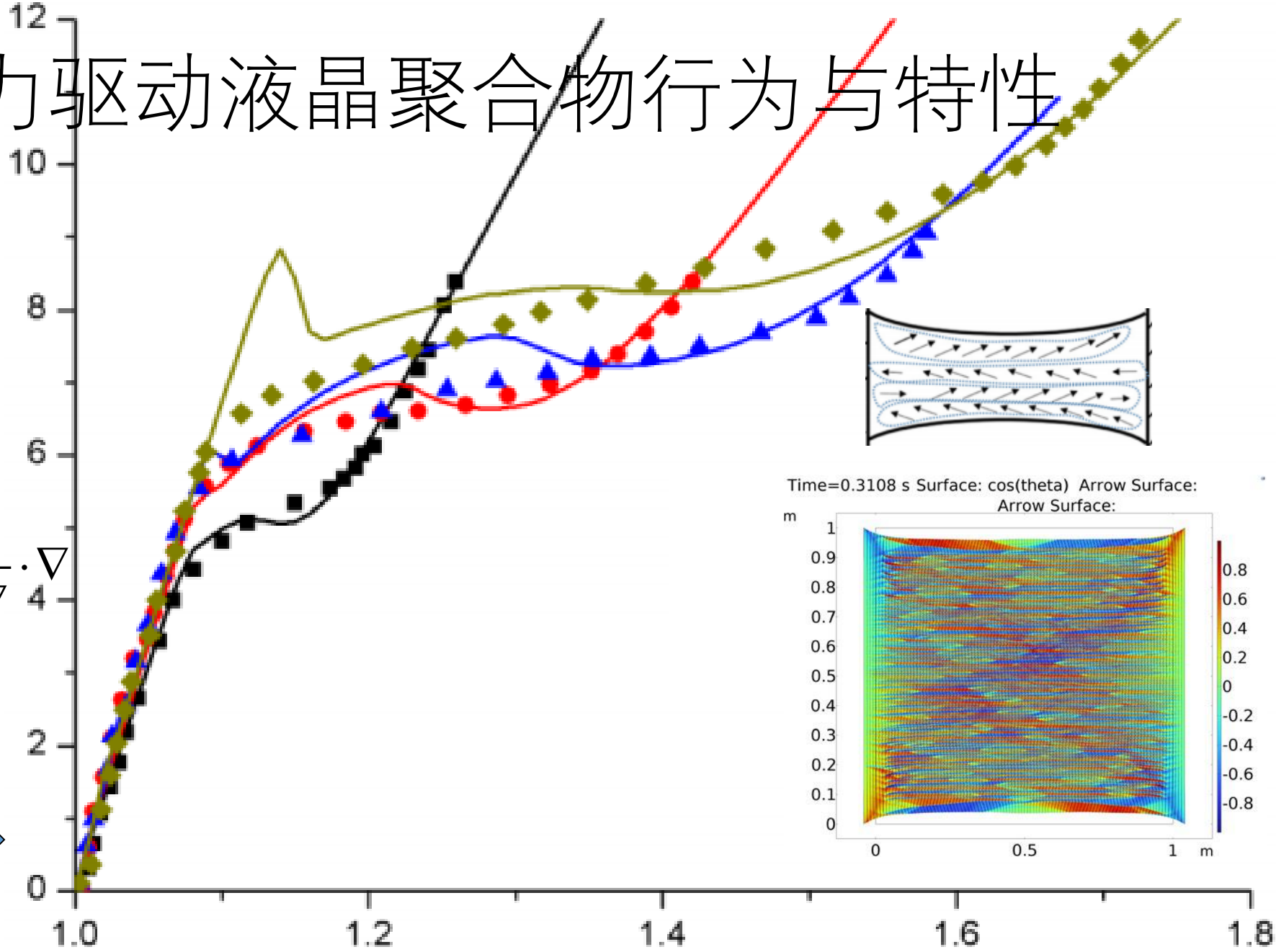



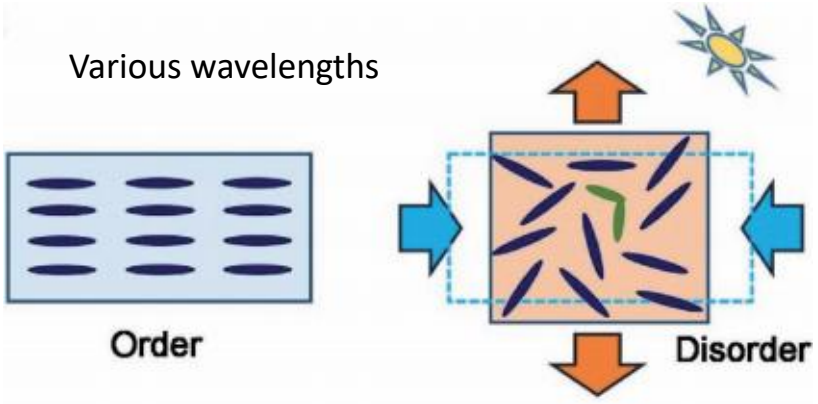
# 光热电力驱动液晶聚合物行为与特性

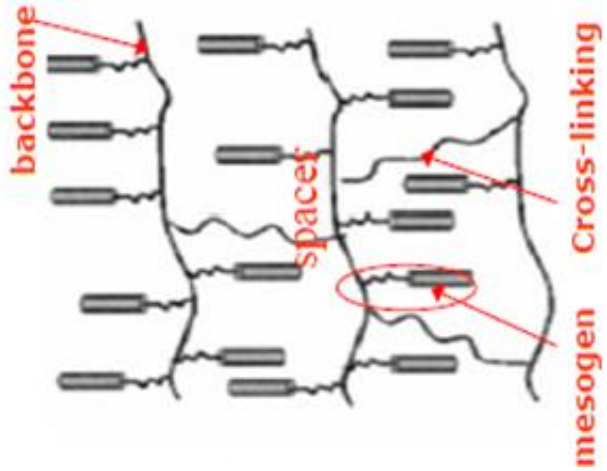
$$\begin{cases} \rho\dot{\mathbf{v}} = \boldsymbol{\sigma}\cdot\nabla + \mathbf{b} \\ \dfrac{\partial R}{\partial \dot{\mathbf{n}}} = \mathbf{k}_{\mathbf{n}} + \gamma\mathbf{n} - \dfrac{\partial f}{\partial \mathbf{n}} + \dfrac{\partial f}{\partial \mathbf{n}\nabla}\cdot\nabla \end{cases}$$

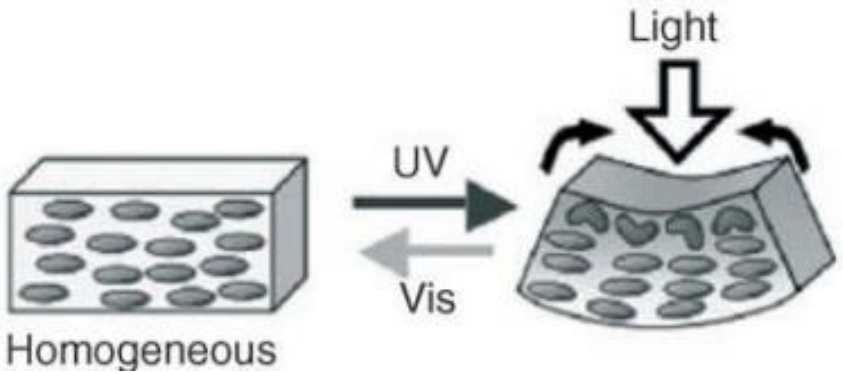


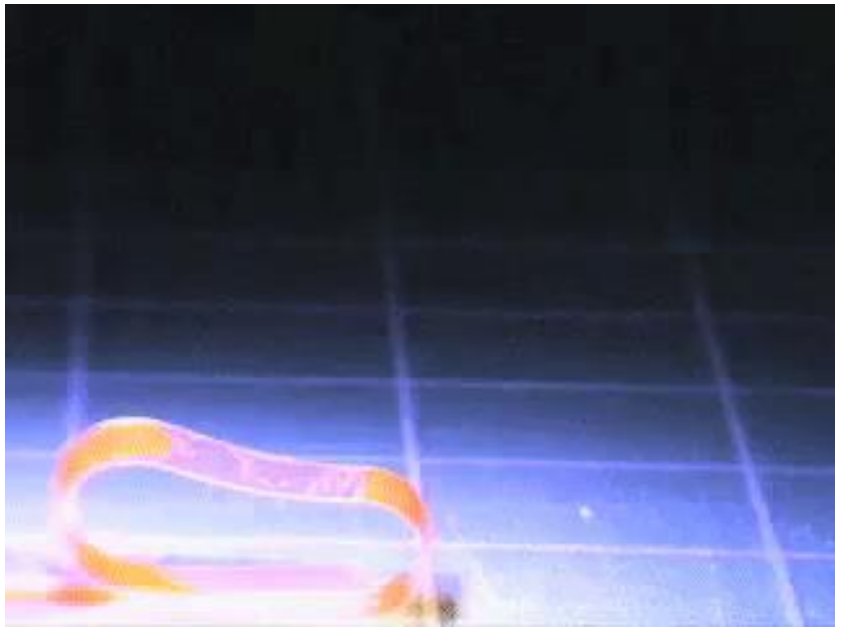


# Photothermally responsive liquid crystals



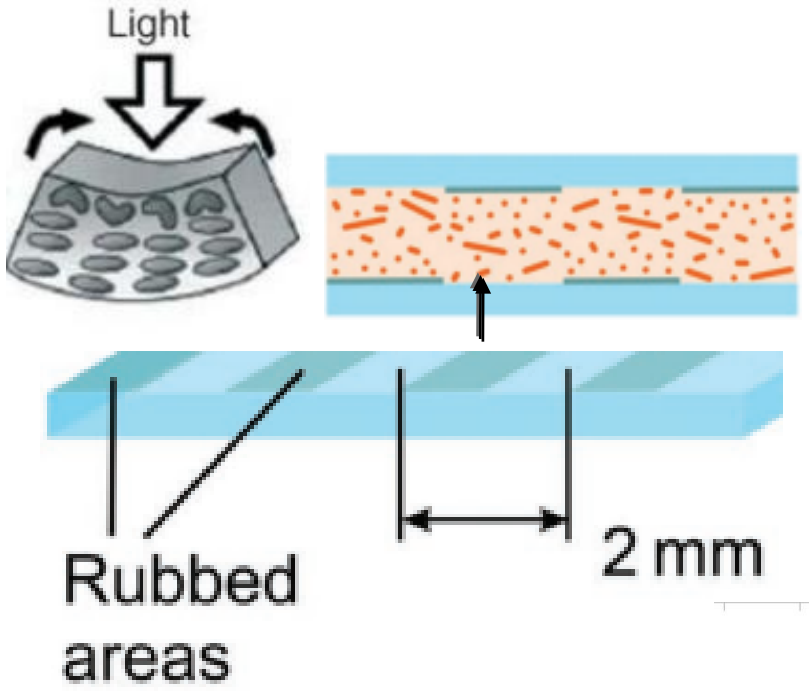



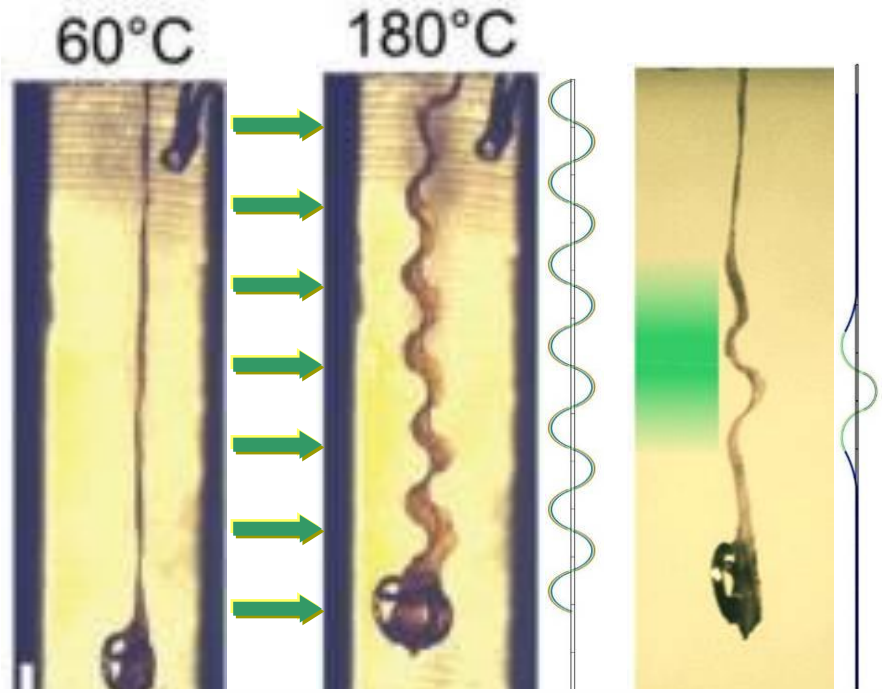



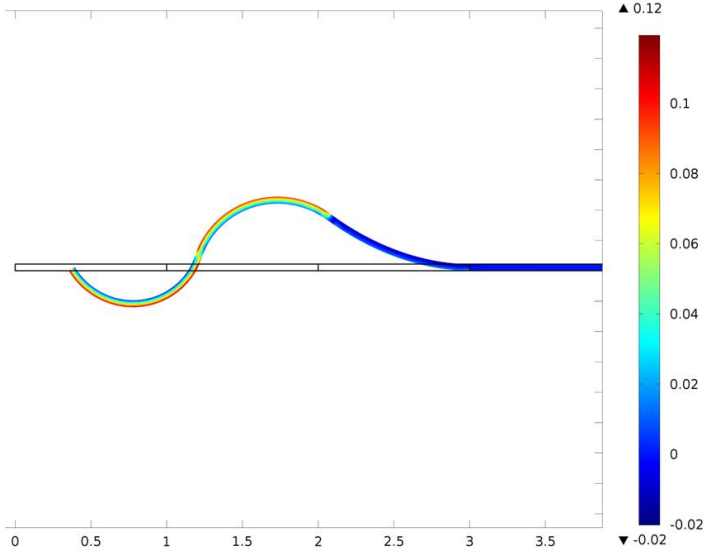



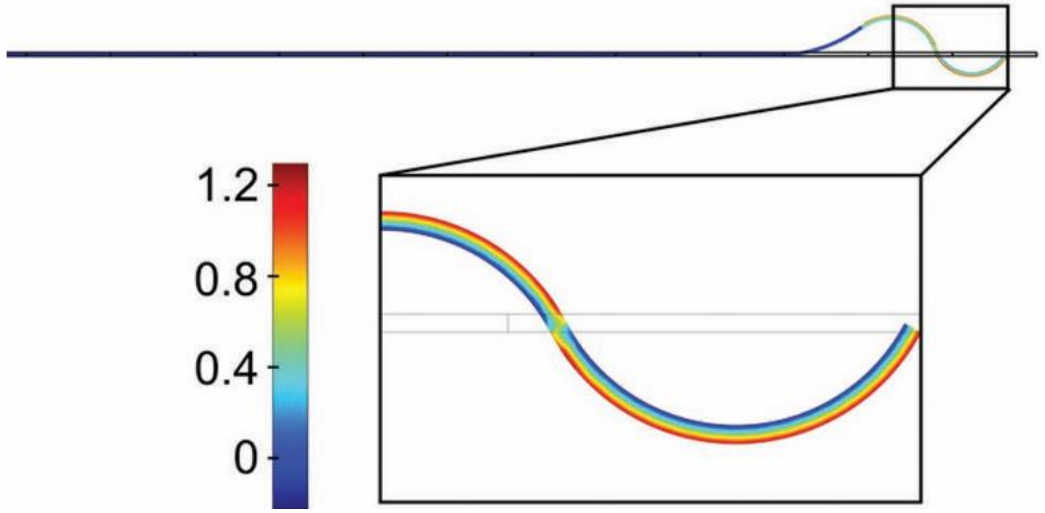
# Liquid crystal robot caterpillar

- Heat/light



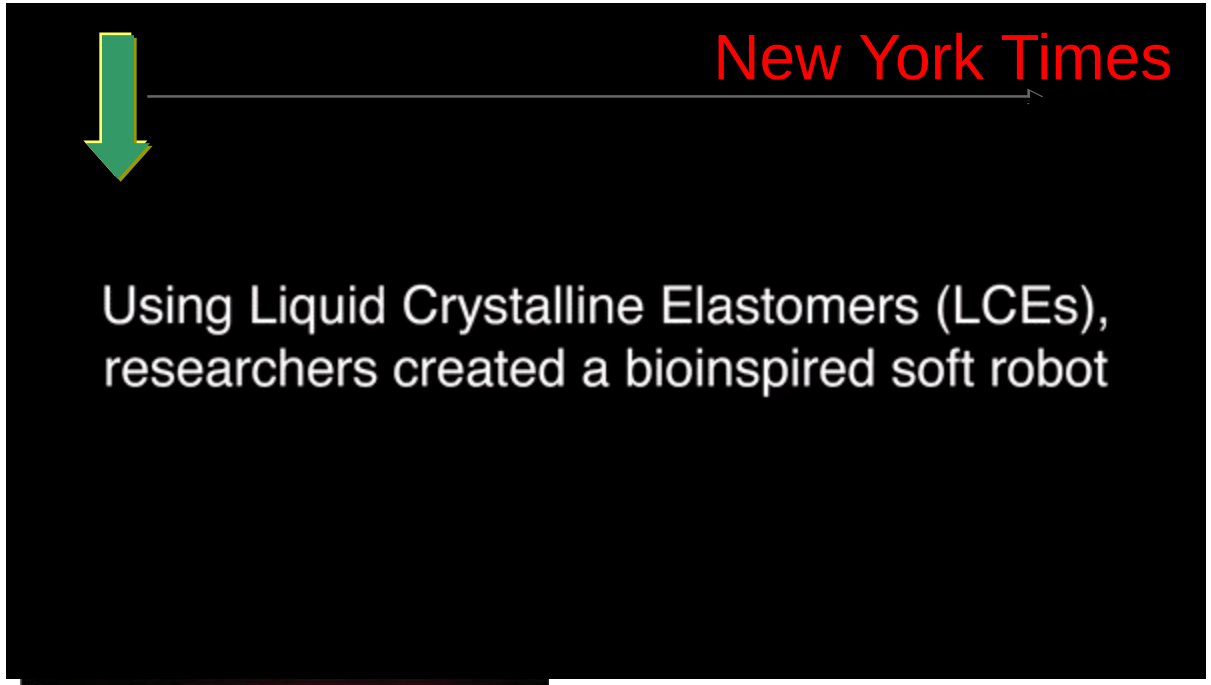



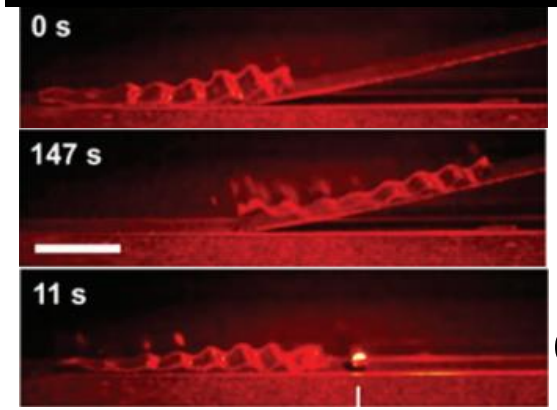



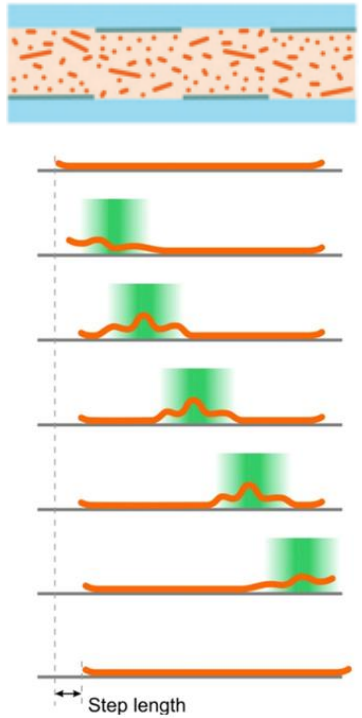

Rogóż[+], Zeng[+], Xuan, Wiersma, Wasylczyk, **Advanced Optical Materials**, 2016

# Liquid crystal robot caterpillar

- Moving light



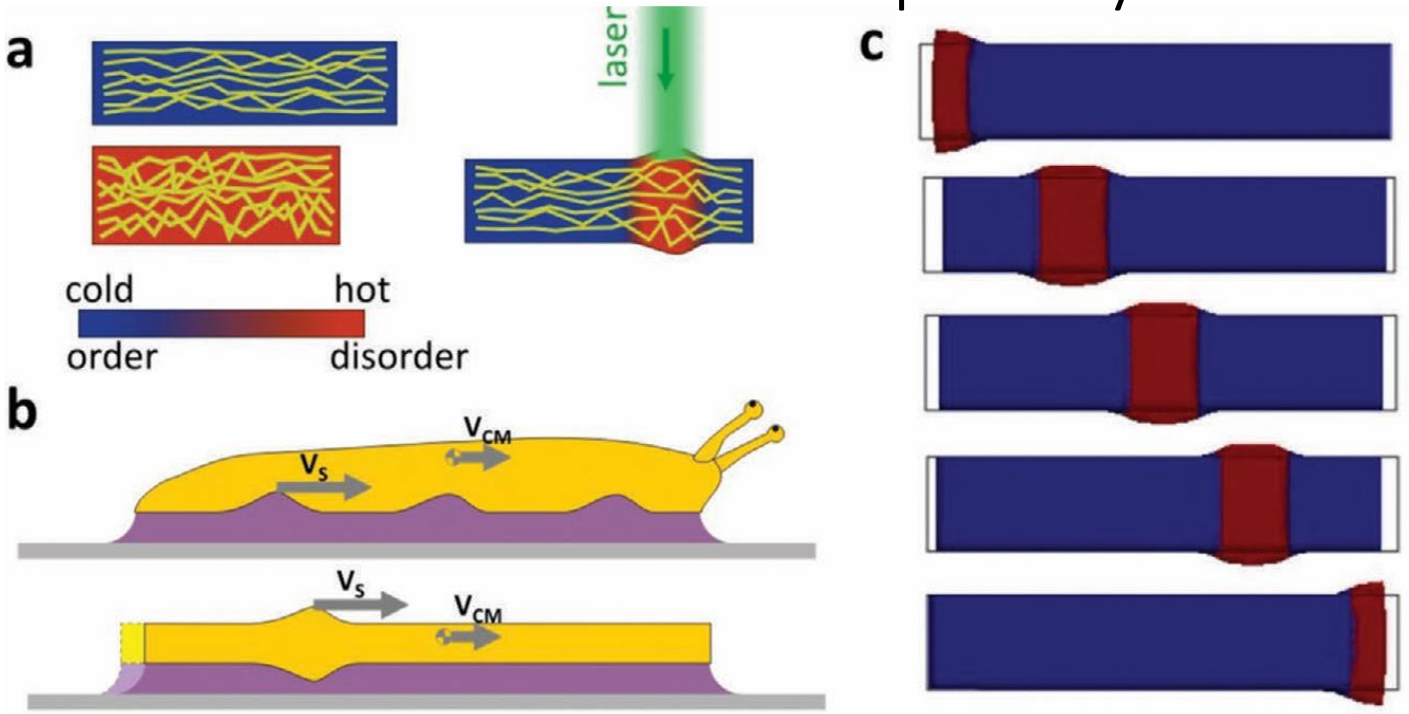



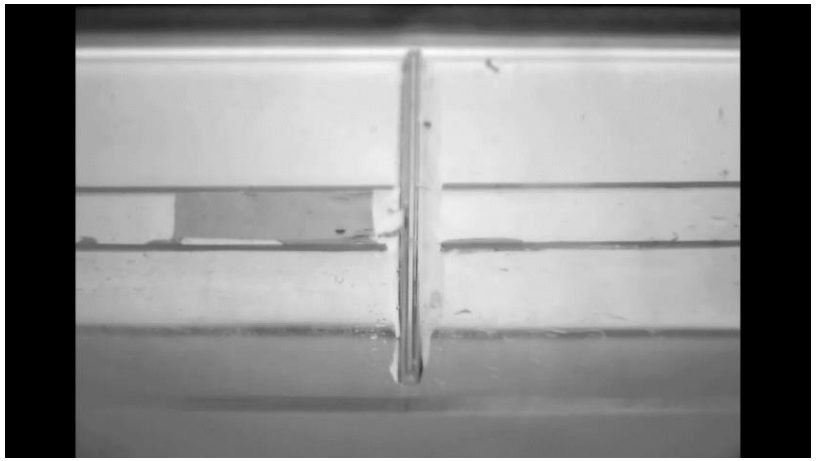




- Slope/ obstacle

Rogóż[+], Zeng[+], Xuan, Wiersma, Wasylczyk, **Advanced Optical Materials**, 2016

# Liquid crystal robot snail

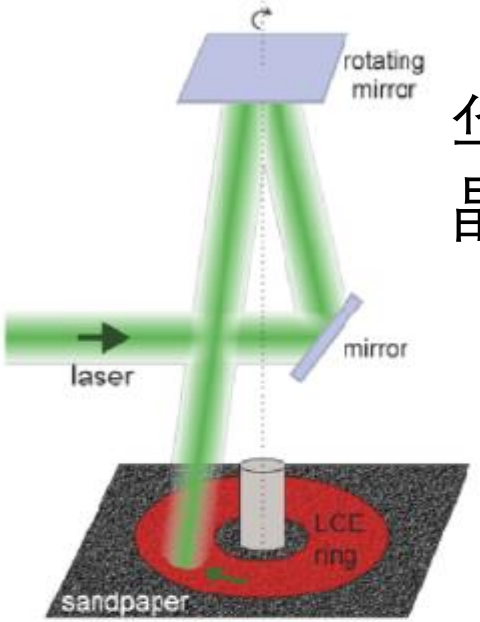


Rogóż, M., Dradrach, K., Xuan, C., & Wasylczyk, P. (2019). A Millimeter-Scale Snail Robot Based on a Light-Powered Liquid Crystal Elastomer Continuous Actuator. **Macromolecular rapid communications**, 40(16), 1900279.

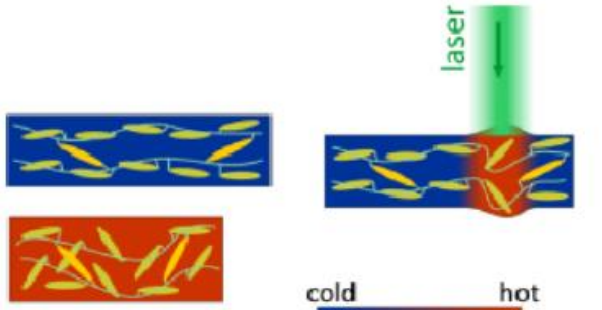
# 液晶聚合物光驱微型旋转马达

华沙大学Wasylczyk课题组的Klaudia Dradrach博士等负责液晶高分子光照实验，结合我的理论与模拟。

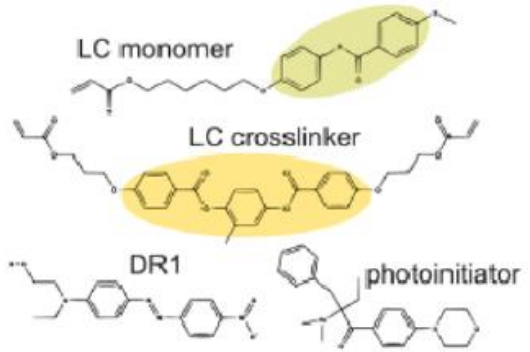



(a)

(b)




(a)

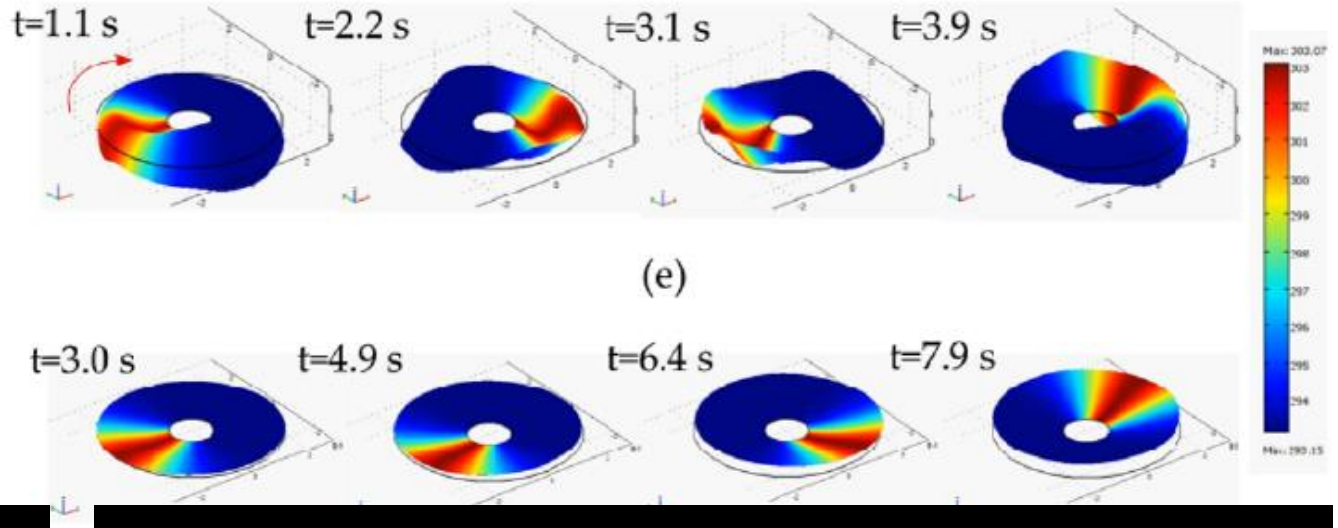



(b)

# 液晶聚合物光驱微型旋转马达

K Dradrach, M Rogóż, P Grabowski, C Xuan, R Węgłowski, J Konieczkowska, E Balcerzak, W Piecek, and P Wasylczyk (2020). Traveling Wave Rotary Micromotor Based on a Photomechanical Response in Liquid Crystal Polymer Networks, ACS Applied Materials & Interfaces, 12 (7), 8681-8686.

# 液晶聚合物光驱微型旋转马达




K Dradrach, M Rogóż, P Grabowski, C Xuan, R Węgłowski, J Konieczkowska, E Balcerzak, W Piecek, and P Wasylczyk (2020). Traveling Wave Rotary Micromotor Based on a Photomechanical Response in Liquid Crystal Polymer Networks, ACS Applied Materials & Interfaces, 12 (7), 8681-8686.