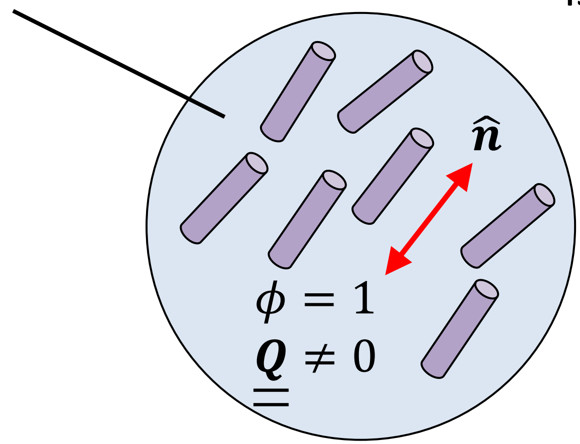
Liquid crystal droplets

<u>We define:</u>

1. Scalar field $\phi(\boldsymbol{r}, t)$
2. Nematic order parameter $\underline{\underline{\boldsymbol{Q}}}\,(\boldsymbol{r}, t)$
3. Velocity field $\boldsymbol{u}(\boldsymbol{r}, t)$

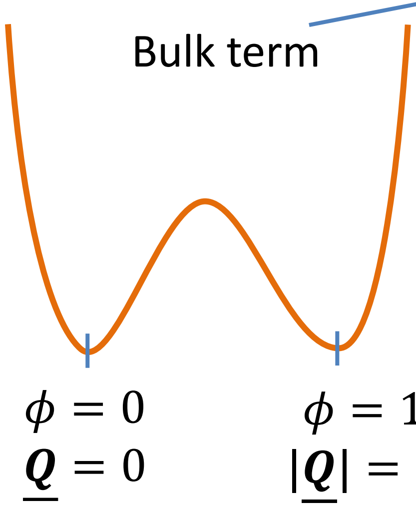


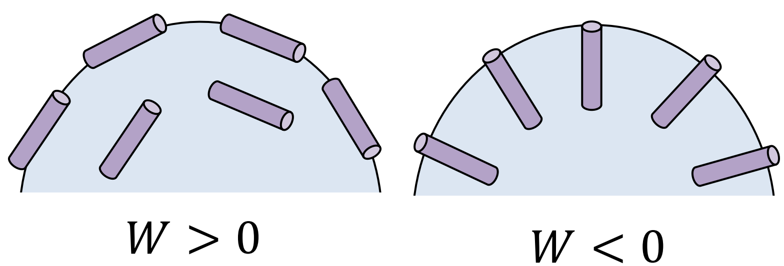
Isotropic fluid
$\phi = 0$
$\underline{\underline{\boldsymbol{Q}}} = 0$

<u>Free energy:</u>

$$F[\phi, \underline{\underline{\boldsymbol{Q}}}] = \int dV \left\{ f_b(\phi, \underline{\underline{\boldsymbol{Q}}}) + \frac{K}{2}(\nabla \underline{\underline{\boldsymbol{Q}}})^2 + W\left(\nabla\phi \cdot \underline{\underline{\boldsymbol{Q}}} \cdot \nabla\phi\right) + \chi \boldsymbol{E} \cdot \underline{\underline{\boldsymbol{Q}}} \cdot \boldsymbol{E} \right\}$$

Bulk term | Elastic energy | Anchoring at interface | External electric field





<u>Dynamics:</u> Navier-Stokes equation coupled to $\dot{\underline{\underline{\boldsymbol{Q}}}}$ and $\dot{\phi}$

[M. E. Cates & E. Tjhung, *J. Fluid. Mech.* (2018)]

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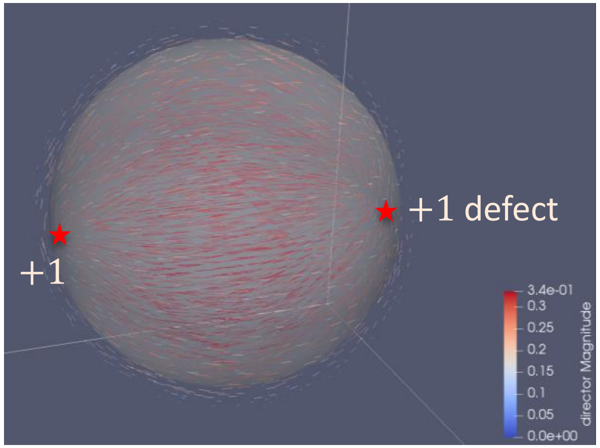
<u>Continuum simulation (lattice Boltzmann):</u>

- Polymer-dispersed liquid crystal droplets



(strong parallel anchoring at interface)