Electronic Supplementary Material (ESI) for Soft Matter.

Supplementary Information: Formation and field-driven dynamics of nematic spheroids

Fred Fu and Nasser Mohieddin Abukhdeir

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1 Multimedia files

- *sphere_formation.mpg*: Video of formation dynamics for a $R \approx 1$ spherical droplet simulation. Hyperstreamlines colored by the magnitude of the uniaxial nematic scalar order parameter S are used to visualize nematic orientation (alignment tensor) and isosurfaces indicate nanoscale defect "core" regions (refer to Methods section). Time is given as a dimensionless quantity.
- *oblate_formation.mpg*: Video of formation dynamics for a $R = 0.5$ oblate droplet simulation.
- *prolate_formation.mpg*: Video of formation dynamics for a $R = 2$ prolate droplet simulation.
- *sphere_fieldon_14Vum.mpg*: Video of field-switching dynamics of a $R \approx 1$ spherical droplet for $E = 14\,\mathrm{V\,\mu m^{-1}} > E_c$ applied along the x-axis.
- *oblate_fieldon_14Vum.mpg*: Video of field-switching dynamics of a $R = 0.5$ oblate droplet for $E = 14\,\mathrm{V\,\mu m^{-1}} > E_c$ applied along the x-axis.
- *prolate_fieldon_14Vum.mpg*: Video of field-switching dynamics of a $R = 2$ prolate droplet for $E = 14\,\mathrm{V\,\mu m^{-1}} > E_c$ applied along the x-axis.
- *sphere_fieldrelease_from_14Vum.mpg*: Video of field-off relaxation dynamics for a $R \approx 1$ spherical droplet simulation.
- *oblate_fieldrelease_from_14Vum.mpg*: Video of field-off relaxation dynamics for a $R = 0.5$ oblate droplet simulation.
- *prolate_fieldrelease_from_14Vum.mpg*: Video of field-off relaxation dynamics for a $R = 2$ prolate droplet simulation.

2 Spherical droplet dynamics

Figures 1, 2 and 3 show visualizations of the formation, field-switching, and field release dynamics for a spherical ($R \approx 1$) droplet, respectively. These are analogous to the dynamics visualizations for oblate and prolate droplets, which are presented in the main text.

3 Droplet order parameter plots

Figure 4 presents alternative plots for the evolution of the droplet order parameter S_d for spherical, oblate, and prolate droplets, with the time axis being plotted on a logarithmic scale.

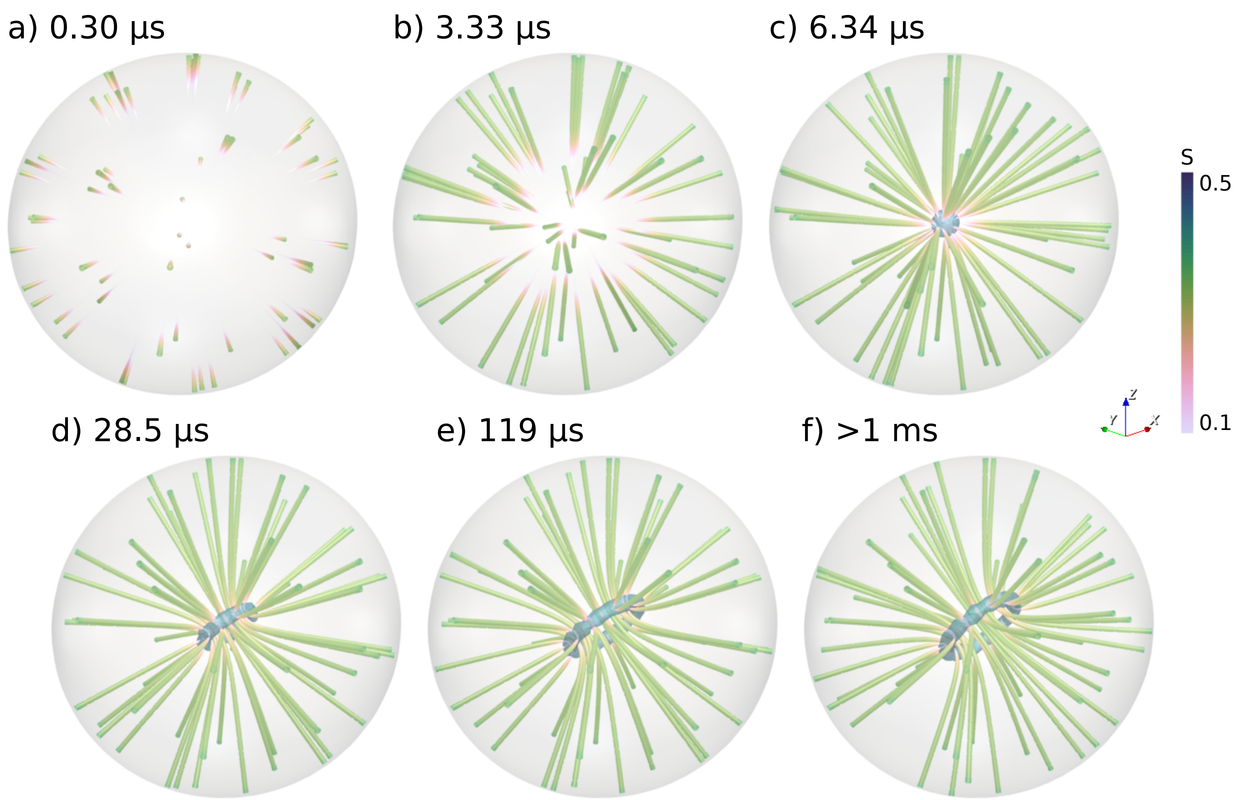


Figure 1: Simulation visualizations of the formation process of a spherical ($R \approx 1$) nematic droplet from an initially isotropic (disordered) state. Hyperstreamlines colored by the magnitude of the uniaxial nematic scalar order parameter S are used to visualize nematic orientation (alignment tensor) and isosurfaces indicate nanoscale defect “core” regions.

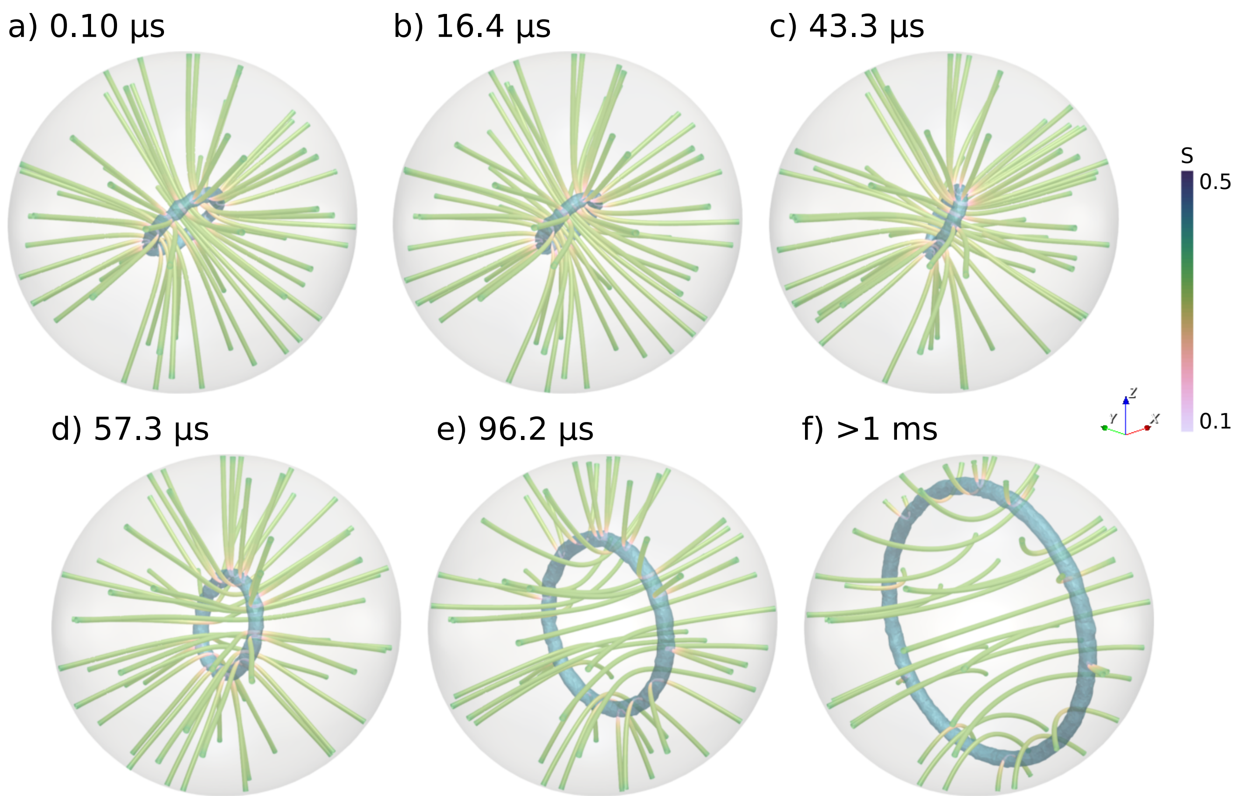


Figure 2: (a-f) Simulation visualizations of the electric field-switching process for $E = 14\,\mathrm{V\,\mu m^{-1}} > E_c$ applied along the x-axis of a spherical ($R \approx 1$) nematic droplet starting from (a) the equilibrium texture (following formation) and proceeding to the (f) the field-driven equilibrium texture. Hyperstreamlines colored by the magnitude of the uniaxial nematic scalar order parameter S are used to visualize nematic orientation (alignment tensor) and isosurfaces indicate nanoscale defect "core" regions.

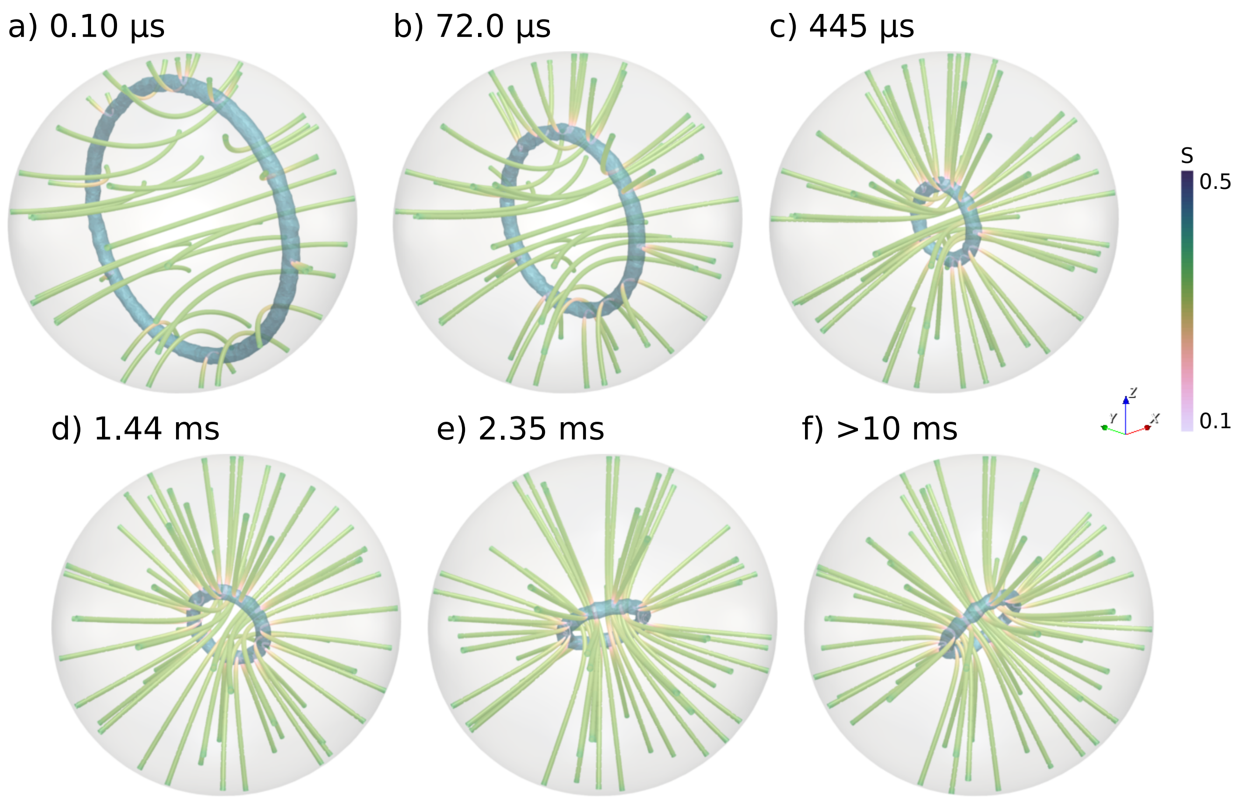
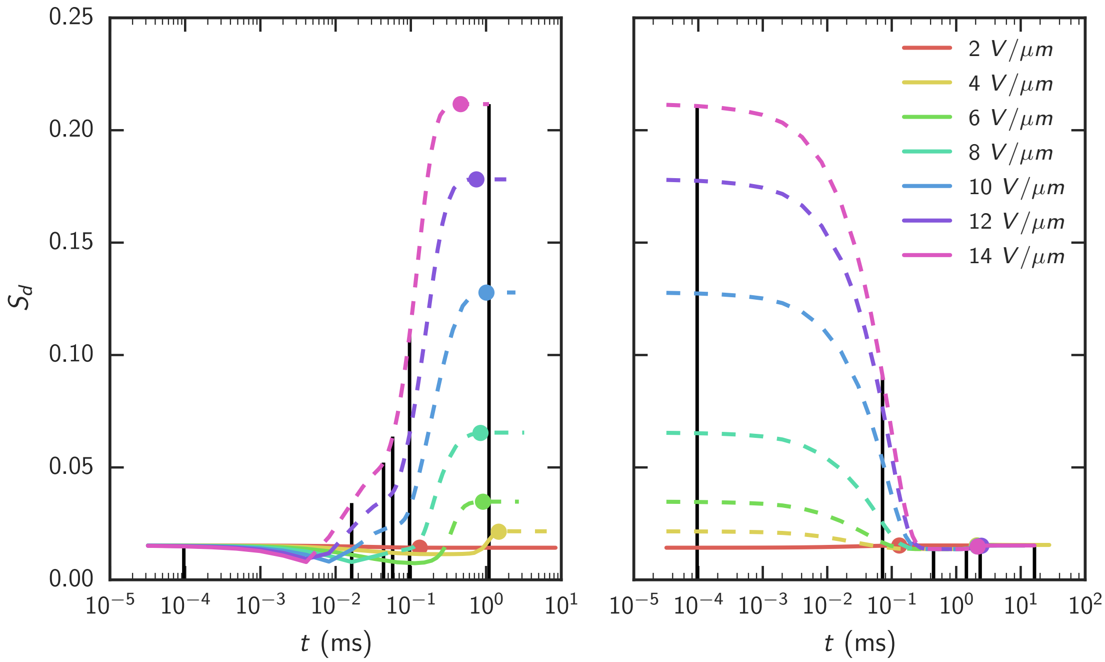
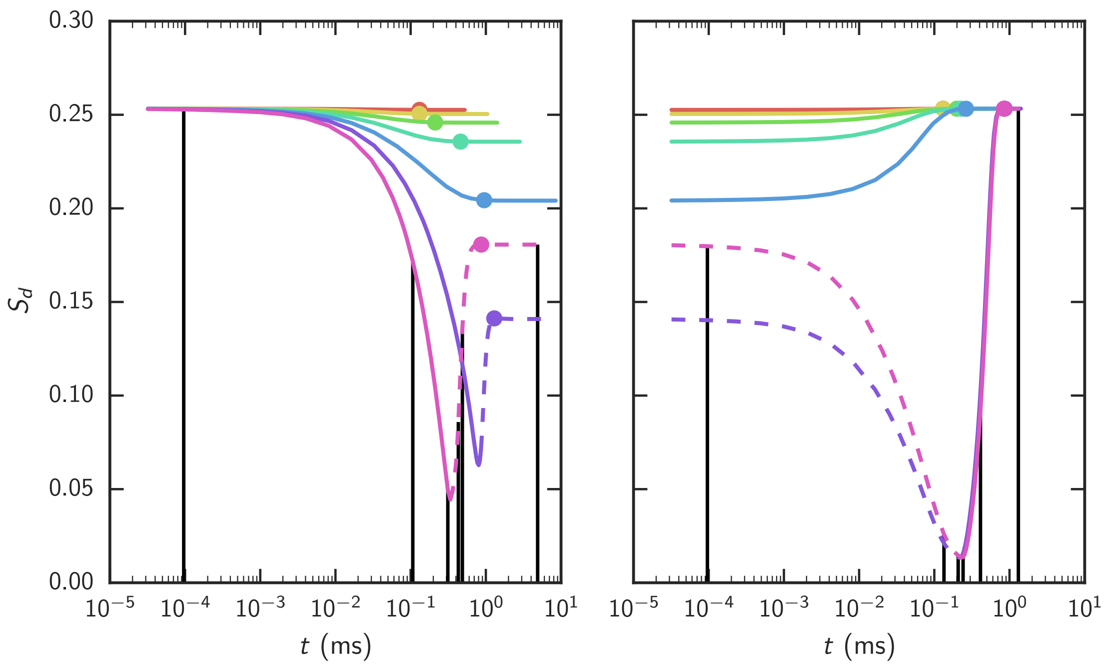


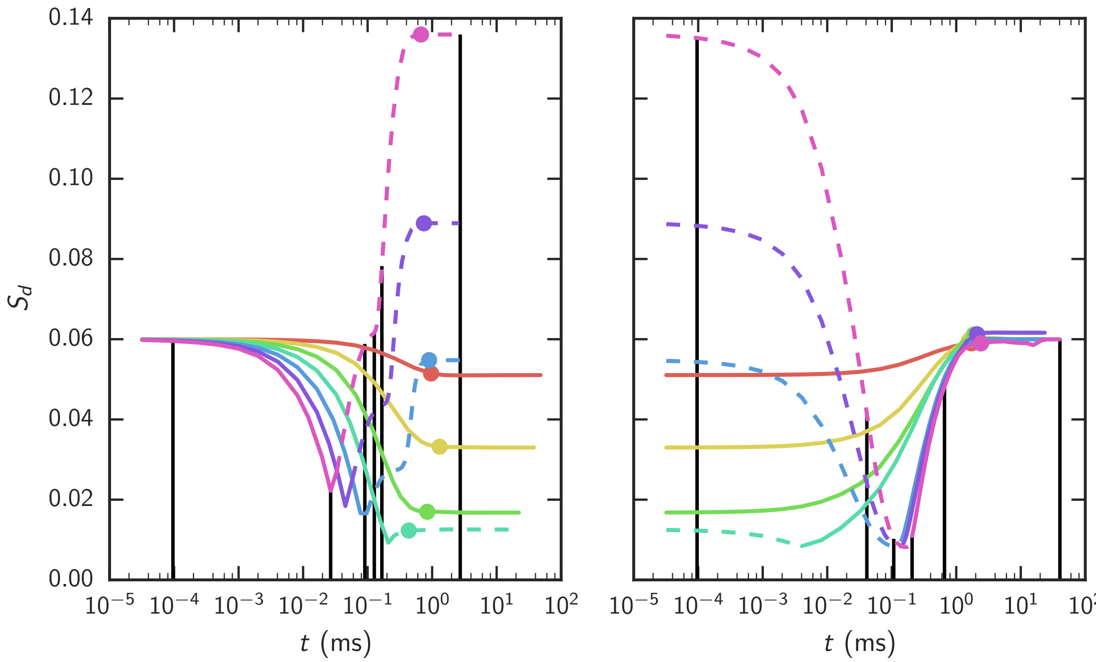
Figure 3: (a-f) Simulation visualizations of the field-off relaxation process after applying a field $E = 14\,\mathrm{V\,\mu m^{-1}} > E_c$ along the x-axis of an spherical ($R \approx 1$) nematic droplet starting from (a) the field-on equilibrium texture and proceeding to the (f) the field-off equilibrium texture. Hyperstreamlines colored by the magnitude of the uniaxial nematic scalar order parameter S are used to visualize nematic orientation (alignment tensor) and isosurfaces indicate nanoscale defect "core" regions.


0.25
0.20
0.15
0.10
0.05
0.00
S_d
10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 10^{0} 10^{1}
t (ms)
10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 10^{0} 10^{1} 10^{2}
t (ms)
2 $V/\mu m$
4 $V/\mu m$
6 $V/\mu m$
8 $V/\mu m$
10 $V/\mu m$
12 $V/\mu m$
14 $V/\mu m$

(a)


0.30
0.25
0.20
0.15
0.10
0.05
0.00
S_d
10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 10^{0} 10^{1}
t (ms)
10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 10^{0} 10^{1}
t (ms)

(b)



(c)

Figure 4: Droplet-scale order evolution plots for (a) $R \approx 1$ spherical, (b) $R = 0.5$ oblate, and (c) $R = 2$ prolate nematic droplets resulting from application (left column) and release (right column) of electric fields with strengths ranging from $E = 2 - 14\mathrm{V\,\mu m^{-1}}$. Curves represent the droplet scalar order parameter S_d with solid/dotted lines corresponding to the droplet director $\boldsymbol{n}_d$ orthogonal/parallel to the electric field direction. Vertical bars (black) indicate the simulation times at which the corresponding simulation snapshots were taken (see main text). The circle markers denote the estimates for the response times $\tau_{\mathrm{on}}/\tau_{\mathrm{off}}$.