Competition between wall anchoring and yielding of nematic platelets under LAOStress and Strain, revealed by 3D Rheo-SAXS

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**Introduction**

Nematic dispersion of colloidal gibbsite platelets show yielding behavior

- **Goal:**
  Study the structural response underlying the yielding behavior
- **Tool:**
  Large Amplitude Oscillatory Strain/Stress measurements combined with a vertical small angle X-ray scattering set-up to probe structure
- **Novelty:**
  3D re-orientational motion and local information

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**Possible configurations**

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**Materials**

- **Gibbsite platelets (AIOOH):**
  - Charged, sides and faces carry the same charges (positive)
  - Relatively thick (\(R=125 \pm 16\) nm, \(d=11 \pm 4\) nm)
  - Relatively monodispersed (-13-20%)
  - Dispersed in glycerol

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**Setup**

- **Rheo-SAXS [2]**
  Vertically deflected X-ray beam is passed through platelet or couvette geometry of a Haake Mars stress controlled rheometer.
- **Advantage**
  Simultaneous Small Angle X-ray Scattering and Rheological measurements
- **Probe**
  - Flow-vorticity plane
  - Low-gradient plane, plus gap scanning

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**Wall anchoring vs. Director motion**

**LAOStress:**

- Full 3-D reorientational motion
- Structural response at low strain: no propagation throughout the gap
- Structural response at high strain: full response through gap, but erratic in the middle
- Stress response mainly due to wall response

**LAOStress:**

- Strong asymmetrical behaviour both in the rheological and the microscopic response [3] (not shown).

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**Cartoon of the dynamic behavior**

- **Response at low strain:**
  - 1\textsuperscript{st} harmonic response \(\Rightarrow\) Dynamic bifurcation
  - High effect of wall anchoring

- **Response at high strain:**
  - 2\textsuperscript{nd} harmonic response
  - Widening followed by flipping
  - Smaller effect of wall anchoring

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