Minicolloque n° CPR4 Not only neutrons ☒ **Oral** ☐ **Poster**

Electric Fields on Small-Angle Neutron Scattering Instruments

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External electric fields are a very useful tool for manipulating matter from the molecular to the micrometre scale. On a molecular level, electric fields has long been exploited in the form of the now ubiquitous liquid crystal display. At larger length scales, they are increasingly being used to direct the self-assembly of nanometre- to micrometre-sized building blocks to form anisotropic materials with useful photonic, structural, transport and rheological properties [1-2].

Anisotropic material systems are often characterized via small-angle X-ray scattering (SAXS) with in-situ electric fields [3]. Such experiments simultaneously provide quantitative information on the structures, interactions, and, crucially, orientations present on the nanoscale. In many organic and soft-matter systems however, the electron density contrast between the sample and the matrix is weak and the samples may undergo damage in the X-ray beam. Both issues can be circumvented through the use of small-angle neutron scattering (SANS), however, to-date only a small handful of custom-built electric field sample environments have been reported in the literature [4,5].

To make this technique more accessible to the soft-matter community, we have built a new "universal" electric field sample environment that is simple, safe and easy to set-up and control on any SANS instrument. The sample environment is temperature-controlled and features external electrodes, allowing standard cuvettes to be used and conducting or ion-containing samples to be investigated without the risk of electrochemical reactions. Using a high-speed, high-voltage amplifier, the field strengths and frequencies reached are comparable to the SAXS analogues. To demonstrate the capabilities of the set-up, we present the results from a study of a guest-host liquid crystal system of polypeptide helices embedded in a thermotropic liquid-crystalline matrix.

Keywords: E-Field, SANS, Liquid Crystals, Anisotropic, Alignment

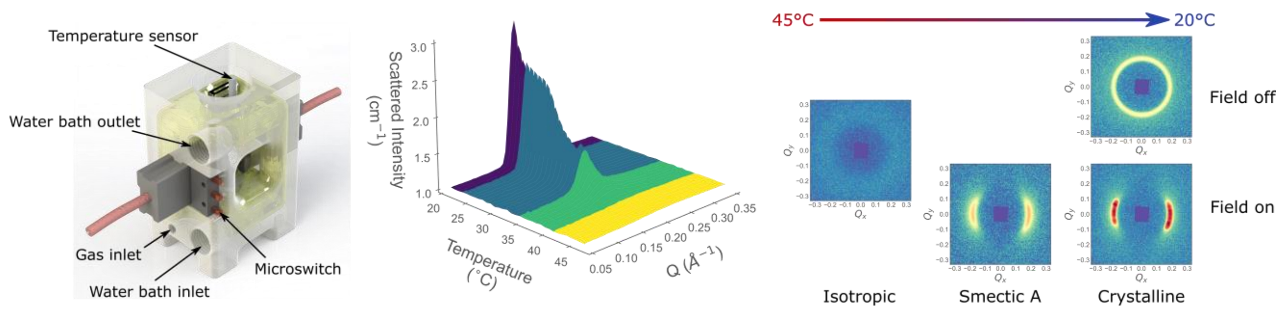

Figure 1. *From left to right: schematic of the sample environment; SANS data from a liquid crystal (LC) cooling in an electric field; detector images showing the different LC phases in the presence or absence of an electric field*

References

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