**Applications of Polar and Ferroelectric Nematics as Electrophoretic Fluids**

Cohort 9, SOFI studentship.

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One of the most exciting areas in Soft Matter Physics is the recent discovery of Ferroelectric Nematic Fluids. It has long been believed that liquid crystals only form nematic phases with equal probability of dipoles parallel or anti-parallel. The director is not actually a vector but a pseudo-vector: **n** = **-n**. But recently, the rule books have had to be rewritten. This began in 2010 with the discovery by Nagaraj of a spontaneously bent nematic state. Then, in 2017, Mandle discovered the a phase with spontaneous splay, which proved to be ferroelectric **n**≠-**n**.

So, Merck are interested to explore what the applications are for such materials. Ideas that should be explored are the Non-linear optical response offered by these materials. This has the potential for ultra-fast electro-optic modulators in optical communications. Another avenue is the use of the materials as ferro-fluids. The ferroelectric polarization offers interesting effects for moving liquids around in response to electric fields; a sort of ferro-phoretic material. This could be useful in switchable lenses for your mobile phone, in micro-fluidic actuators, or perhaps in ultra bright full-colour reflective displays.

This will be an experimental PhD that takes advantage of the world class laboratories at Leeds, that include a dedicated clean-room for making liquid crystal devices, and generously equipped soft matter characterization labs. In addition to this, the project has a lot of potential for generating new IPR in the form of patents, and perhaps spin-out companies for the entrepreneurial spirited student.