Nano-patterned surfaces and structures for augmented reality and virtual reality applications

Mamatha Nagaraj[1], Helen Gleeson[1], Gordon Love[2], Richard Mandle[1,3]

[1]School of Physics and Astronomy, University of Leeds
[2]School of Computer Science, University of Leeds
[3]School of Chemistry, University of Leeds

Contact: m.nagaraj@leeds.ac.uk

This project will focus on developing liquid crystal based optical components for AR VR devices using nano-patterned surfaces and structures.

Liquid crystals are a remarkable class of soft materials that combine properties of conventional crystals and liquids. Liquid crystals (LC) are sensitive to their interaction with contacting surfaces and LC devices show unique optical response when an electric field is applied across it, making these materials invaluable for display devices and as optical components.

Augmented reality and virtual reality technologies have potential to revolutionize the ways we perceive and interact with digital information. However, achieving satisfying user experience ensured by high quality optics requires tuneable materials such as LCs with extremely accurate fabrication processes for AR/VR devices. Liquid crystal displays and LC based optical components play an important role in AR and VR applications. LC devices are used to boost image quality, brightness, as waveguides and to reduce power consumption in AR/VR. However, there are still challenges including overcoming chromatic aberration and optical losses, operating in broadband optical spectra, achieving longer lifetime, etc.

In this project the student will work on fabricating and characterising optical performance of novel liquid crystal devices suitable for AR/VR. The work involves understanding current AR/VR technologies and analysing material properties and device designs to realise the next generation devices. The student specifically will investigate the device performance by spatially varying the birefringence of the surfaces, introducing non-linear profiles and aspect ratios, optimising device geometry and creating meta-surfaces. The project also offers exciting opportunities to optimise formulations for the fabrication processes and understand technical requirements working towards demonstrators for real world applications.

The project is ideal for a student interested in experimental physics. A wide range of different skills will be developed during the project including fabricating devices in cleanroom environment, using photolithography and photo-alignment, assessing materials and device properties using techniques such as dielectric and Raman spectroscopy, eletro-optic characterisation methods and electron microscopies.

This studentship will be part-funded by the company Merck and student will benefit from direct interaction with scientists at Merck and gain experience in a variety of laboratory methods at Merck. At Leeds the student will have a unique opportunity to work with scientist from chemistry, computing, physics and engineering.