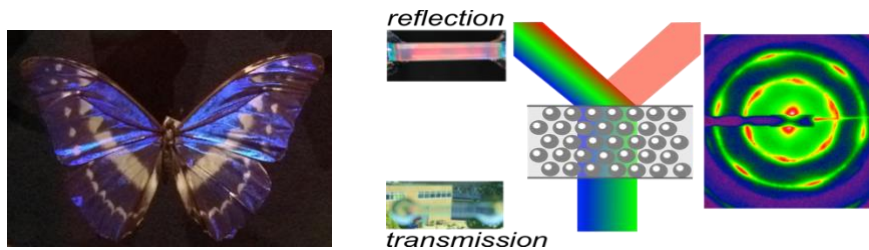


## Colloidal Systems with Structural Colours



### Motivation

In nature we find butterflies, beetles, flowers but also bird wings and opals with intense coloration. Such strong, pure colours do not arise from pigment molecules that adsorb a fraction of the wavelengths in the visible region but from the highly ordered structure of the underlying building blocks [1]. An example are opals, which are semi-precious stones: their colour stems from the periodic arrangements of sub-micron-sized silica colloids. When large there are simply transparent glass, but it is the periodicity of high to low refractive index in the crystalline arrangement of these beads that will reflect only a narrow band of wavelengths (see the red in the Figure above [2]) while the rest is being transmitted. Although it is very difficult to make large colloidal crystals with such structural colours, researchers and in particular industry are highly interested in developing new materials with such optical properties.

### Your Project

In this project we will extend recent studies on 200 nm large, fluorinated particles that form charge-stabilized, face-centred cubic crystals in aqueous solutions. By changing the colloidal concentration, the reflected colour of such suspensions can be tuned continuously from blue to green to red. The aim will be twofold: synthesizing these colloids and dope them with various and playing with the background fluid to improve the materials reflectivity and to solidify the samples such that they can be made mechanically stable for applications such as waveguides or for light harvesting purposes.

### Requirements

Background in statistical physics and optics would be advantageous. The applicant should not be afraid of doing a bit of chemistry.

### Other aspects

The experimental study will be supervised by the Prof. Eiser, an experienced Soft Matter Physicist. We will also interact with Prof. Yang Lan from University College London, who is an experienced colloid synthesist.

### Contact persons

Eiser Erika ([erika.eiser@ntnu.no](mailto:erika.eiser@ntnu.no))

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- [2] T. Erdem, T. O'Neill, M. Zupkauskas, A. Caciagli, P. Xu, Y. Lan, P. Bösecke, E. Eiser 'Transparent Colloidal Crystals With Structural Colours' *Front. Phys.* 10:847142 (2022)