INSTITUT ZA FIZIKU
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HRVATSKO BIOFIZIČKO DRUŠTVO

Seminar @Institute of Physics (joint IoPZg, IRB & HBD seminar), Friday 18th September 2026 at 11:00, 1st wing lecture room & Zoom

Cellulose nanocrystal self-assembly into nanostructured photonic materials

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Valorisation of biomass into high value materials requires efforts spanning from understanding structural properties of feedstock to controlling the physics and chemistry of processing steps and assembly principles into final functional architectures. Cellulose, as the most abundant biopolymer on Earth, can be isolated from a variety of sources and presents a native hierarchical structure impossible to replicate artificially. Under suitable conditions, its processing allows to extract its crystalline compounds, called cellulose nanocrystals (CNCs). These are anisotropic and chiral colloidal nanorods represent a promising building block for the development of renewable and multifunctional nanomaterials. Remarkably, CNC suspensions can spontaneously form a colloidal liquid crystal above a threshold volume fraction, presenting a cholesteric order, and upon further solvent evaporation they can produce nanostructured films that display strong spectral reflection in the visible range, resulting in vivid structural colour.[1]

In this talk, I aim to give an introduction about cellulose nanocrystal extraction and properties, as well as their material relevance for self-assembled optical materials. I will develop on the recent progress to understand the link between their morphology and their liquid crystalline behaviour,[2] how to control their assembly to manipulate their optical properties,[3] and how to develop scalable strategies for optical materials. [4-5] If time allows, I will say a few words about other systems of interest, such as polymeric liquid crystals, alignment under external fields, confinement effects, and buckling instabilities.

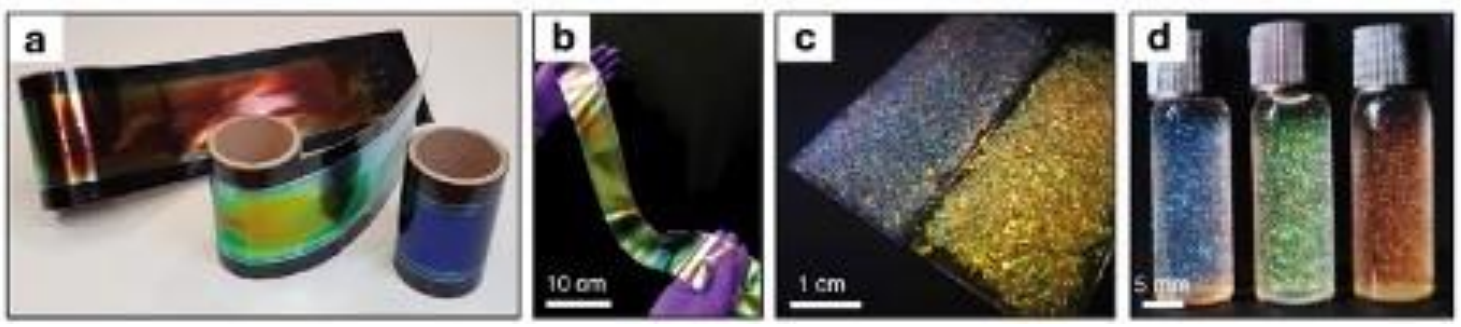

Figure 1. Examples of coloured CNC-based films (a, b) and their development into cellulose glitter (c, d).

References

[1] BFP, T. G. Parton, C. Honorato-Rios, A. Narkevicius, K. Ballu, Q. Shen, Z. Lu, Y. Ogawa, J. Haataja, B. Droguet, R. M. Parker, S. Vignolini, Chem. Rev., 123, 12595 (2023)
[2] T. G. Parton, R. M. Parker, G. T. van de Kerkhof, A. Narkevicius, J. S. Haataja, BFP, S. Vignolini, Nat. Commun., 13:2657, (2022)
[3] BFP, G. Kamita, G. Guidetti, S. Vignolini, Phys. Rev. Mater., 3, 045601 (2019)
[4] R. M. Parker, T. H. Zhao, BFP, S. Vignolini, Nat. Commun., 13:3378, (2022)
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