

The Lars Onsager Professor 2023



Dr. Maria Helena Godinho
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will present the lecture

Self-organized cellulose-based liquid crystalline systems: a world of opportunities

Wednesday, 23 August 2023 at 11:15–12:00
R5, Realfagbygget, Gløshaugen, NTNU

Abstract: Self-organized cellulose-based twisted structures are all around us, mainly in plants, being a source of cellulose materials and inspiration to fabricate systems with properties that mimic natural designs, functions, and properties. At the genesis of some of these structures, for example, those found in the cell wall of some fruits and leaves, are cellulose nanocrystals (CNC) that assemble in cholesteric structures [1, 2]. Also, colloidal suspensions of cellulose nanorods were found to self-assemble into lyotropic liquid crystalline phases, which can be explained by Onsager's theory developed in his seminal work published in 1949 [3]. Onsager demonstrated that lyotropic nematic phases arise from a compromise between individual nanorods' rotational and translational entropies.

This presentation first addresses cellulose-based chiral molecular systems and nanoscale helicoidal arrangements. Attention is given to cellulose nanocrystals, water interactions, and out-of-equilibrium structural colorful structures formed by cellulose-based systems.

The discussion progresses to the micro and millimeter scales, where specific examples are presented to showcase specialized helical cellulose-based organizations. The chosen examples illustrate the formation of different helicities, adaptative shapes, and movements at varying length scales, such as in vascular leaf petioles in tendrils and awns of *Erodium* fruits.

[1] M. H. Godinho, *Science* **2020**, 369, 918.

[2] A. P. C. Almeida, J. P. Canejo, S. N. Fernandes, C. Echeverria, P. L. Almeida, M. H. Godinho, *Adv. Mater.* **2018**, 30, 1703655.

[3] L. Onsager, *Ann. N. Y. Acad. Sci.*, **1949**, 51, 627.



On this occasion, Dr Godinho will receive the Onsager Medal from Øyvind Weiby Gregersen, the Dean of the Faculty of Natural Sciences, NTNU

