UNIVERSITÉ DU LUXEMBOURG

Physics meets Biology online Colloquium

Monday, 22 February 2021 at 3 pm

Talk by Dr. Pierre RONCERAY

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(Invited by Assistant Prof. Étienne FODOR)

Elastically limited liquid-liquid phase separation inside cells

Abstract:

Many intracellular bodies have been shown to be membrane-less liquid droplets that form through liquid-liquid phase separation (LLPS), both in the cytoplasm and in the nucleoplasm. In contrast to the archetypal oil-in-water demixing, the intracellular environment puts mechanical constraints to the formation of large droplets. In the cell nucleus, in particular, the elastic response of the chromatin network has been shown to oppose LLPS. Here we theoretically consider three scenarios by which LLPS can occur in such an elastic network: (i) by cavitation of large droplets that exclude the network, (ii) by forming many mesh-size-scale microdroplets in the pores of the network, and (iii) by permeating through the network and including it in large droplets. We propose simple criteria for which scenario is preferred, introducing a phase diagram controlled by the trade-off between elastic modulus, liquid-liquid surface tension, and liquid-network wetting properties. Our theory predicts the possibility of yet-unobserved mesh-size-limited liquid droplets in the cytoplasm and nucleoplasm.

Biography:

I am a soft matter and biophysics theorist, with interests in protein condensation and self-assembly, cell mechanics, and stochastic inference methods. I am currently a principal investigator at Centuri/CPT, Université Aix-Marseille, France. I did my postdoctorate at Princeton University, USA, and my PhD at Université Paris-Saclay, France.