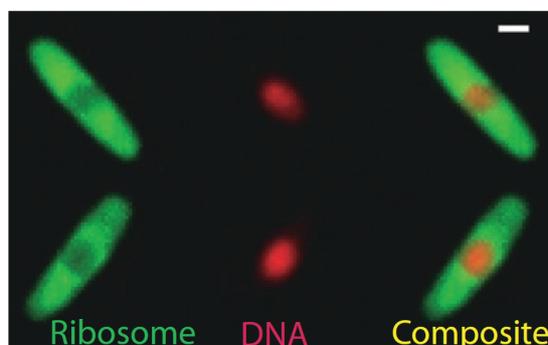


Coarse-Grained Modeling of the Compaction of Bacterial DNA

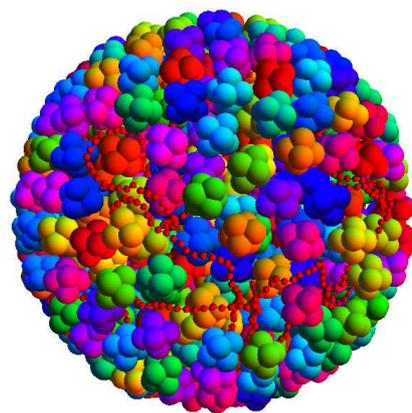
Motivation

The volume occupied by unconstrained bacterial DNA in physiological saline solutions exceeds 1000 times the volume of a cell. Still, DNA is confined to a well defined region of the cell called the nucleoid, which occupies only a small fraction of the cell volume (the red sphere in the fluorescence microscope image to the right). This is rather puzzling, because bacterial DNA is not delimited by a membrane, in sharp contrast with the nucleus of eukaryotic cells. Although this question has been debated for several decades, there is still no general agreement on the mechanism leading to the compaction of the DNA and the formation of the nucleoid.



Detailed subject

The work will consist in developing coarse-grained models of the cytoplasm to help discriminate between the various mechanisms that have been proposed to rationalize the compaction of the bacterial DNA inside the nucleoid. Since we have recently suggested that demixing between DNA and ribosomes may drive compaction (see the references below), special attention will be paid to modeling adequately DNA, RNA, the ribosomes, as well as their respective interactions. It is hoped that a detailed understanding of the compaction and of the recent microscopy experiments with sub-wavelength resolution will emerge from the simulations.



Publications linked to the theme

- ***In vivo* compaction dynamics of bacterial DNA: A fingerprint of DNA/RNA demixing ?**
M. Joyeux, *Curr. Opin. Colloid Interface Sci.* **26**, 17-27 (2016)
- **Compaction of bacterial genomic DNA: Clarifying the concepts**
M. Joyeux, *J. Phys.: Condens. Matter* **27**, 383001 (2015)

Background and skills expected

The student should appreciate to work with computers and be familiar with writing codes.

Supervisor : Marc Joyeux

Laboratory : Laboratoire Interdisciplinaire de Physique

Team/Group : Physique Statistique et Modélisation

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This Master internship could be extended into a PhD within the same research subject : YES