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[Title]

Toward an understanding of DNA architecture in living cells: from modeling to direct X-ray imaging

[Abstract]

Characterization of mezoscopic architecture of cell DNA and its structural dynamics remains elusive goal in spite of its attractiveness due to supposed role in cell programming and details of genomic expression. While details unknown, the architecture is hierarchical on several spatial scales down to nanometer range.
New generation of coherent X-ray sources promises to obtain within few years eventually sub-nm resolution images of single, non-repeatable biological objects. However, at present state, whole cell imaging for cells bigger than few μm requires fixed-target imaging where radiation damage limits resolution of biological objects to about 10 nm[1]. Diffract-before-destroy experiments enabled by free-electron X-ray lasers are able to circumvent radiation damage, but still provide only 2D images instead of 3D information at the price of nontrivial data processing [2].
At the moment, we believe the combination of DNA-aptamer metallic nanoparticle contrasting strategies, fixed-target ptychography and tomography[3] and coarse grained modeling of mesoscopic DNA motifs[4] are the most viable intermediate steps toward reconstruction of 3D architecture of cell DNA and we will present our steps along this direction.

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