

MAR15-2014-020279

Abstract for an Invited Paper
for the MAR15 Meeting of
the American Physical Society

A physical analysis of nucleosome positioning

ULRICH GERLAND, Physik Department, Technische Universität München, Munich, Germany

The first level of genome packaging in eukaryotic cells involves the formation of dense nucleosome arrays, with DNA coverage near 90% in yeasts. A high nucleosome coverage is essential for cells, e.g. to prevent cryptic transcription, and the local positions of specific nucleosomes can play an important role in gene regulation. It is known that in vivo nucleosome positions are affected by a complex mix of passive and active mechanisms, including sequence-specific histone-DNA binding, nucleosome-nucleosome interactions, ATP-dependent remodeling enzymes, transcription, and DNA replication. Yet, the statistical distribution of nucleosome positions is extremely well described by simple physical models that treat the chromatin fiber as an interacting one-dimensional gas. I will discuss how can we interpret this surprising observation from a mechanistic perspective. I will also discuss the kinetics of the interacting gas model, which is pertinent to the question of how cells achieve the high nucleosome coverage within a short time, e.g. after DNA replication.