DNA KNOTTING UNDER GEOMETRICAL CONSTRAINS: ORGANIZATION OF DNA IN PHAGE CAPSIDS

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The packing geometry of chromosomes is mostly unknown. In some viruses such as icosahedral bacteriophages and adenoviruses, the genome is packed to near-crystalline density and achieve one of the highest levels of DNA condensation found in nature. Despite numerous studies, some essential properties of the packaging geometry of the DNA inside the phage capsid are still unknown. We present a knot teory based approach to the problems of randomness and chirality of the packed DNA. We recently showed that most DNA molecules extracted from bacteriophage P4 are highly knotted because of the cyclization of the linear DNA molecule confined in the phage capsid. Here, we show that these knots provide information about the global arrangement of the DNA inside the capsid.Our results indicate that the packaging geometry of the DNA inside the viral capsid is writhe-directed. We also investigate other topological and physical constrains that affect the knotting probability and knot distribution of DNA molecules.

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