UNIVERSITÀ DEGLI STUDI DI BERGAMO
FACOLTÀ DI ECONOMIA

Dipartimento di Matematica, Statistica, Informatica e Applicazioni "Lorenzo Mascheroni"

SEMINARIO

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ore 16,00

Bergamo, Via dei Caniana 2 – Aula 21

Mathematical modelling of DNA supercoiling

Prof. Renzo Ricca

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Il seminario è aperto a tutti gli interessati

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Mathematical modeling of DNA supercoiling

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ABSTRACT

The largest chromosome in the human genome contains about 18 mm of DNA that is believed to exist as one giant molecule, that gets packed into a structure by a factor of 10.000. In order to achieve such high level of condensation the DNA filamentary structure folds and supercoils its double-stranded genomes to near-crystalline density. In recent years mathematical models have been introduced to investigate various mechanisms of coiling and packaging, accompanied by a growing interest in the study of structural complexity of physical and biological systems [1]. In the simplified context of linear elastic theory of thin rods, and under conservation of filament topology, it has been shown [2] that natural supercoiling is energetically favoured by twist reduction and writhe generation. High degree of coiling can however be achieved without necessarily requiring high twist. New results by Maggioni & Ricca [3] demonstrate that high coiling can be produced efficiently and economically at relatively low energy levels and topological complexity. These results, presented here, shed new light on possible localized packaging mechanisms and support genetic transmission models based on spooling processes.

[1] Ricca, R.L. 2005 Structural complexity. In *Encyclopedia of Nonlinear Science* (ed. A. Scott), pp. 885-887. Routledge, New York and London.
[2] Ricca, R.L. 1995 The energy spectrum of a twisted flexible string under elastic relaxation. *J. Phys. A: Math. & Gen.* **28**, 2335-2352.
[3] Maggioni, F. & Ricca, R.L. 2006 Writhing and coiling of closed filaments. *Proc. R. Soc.* A **462**, 3151-3166.