# APPLIED TOPOLOGY DAY

The Mathematical Institute, Oxford will host a one day meeting on **Monday, February 28** on topology and its applications.

14:15 Dorothy Buck, Imperial
*The Classification of Rational SubTangle Adjacencies, with Applications to Complex Nucleoprotein Assemblies*

15:45 Michael Farber, Durham
*Stochastic Algebraic Topology*

17:00 Jacek Brodzki, Southampton
*Geometry and topology of data sets*

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## Abstracts

D. Buck: (Joint work with Ken Baker) Many proteins cleave and reseal DNA molecules in precisely orchestrated ways. Modelling these reactions has often relied on the axis of the DNA double helix being circular, so these cut-and-seal mechanisms can be tracked by corresponding changes in the knot type of the DNA axis. However, when the DNA molecule is linear, or the protein action does not manifest itself as a change in knot type, or the knots types are not 4-plats, these knot theoretic models are less germane.

We thus give a taxonomy of local DNA axis configurations. More precisely, we characterise all rational tangles obtained from a given rational tangle via a rational subtangle replacement (RSR). This builds on work of Berge and Gabai. We further determine the sites for these RSR of distance greater than 1. Finally, we classify all knots in lens spaces whose exteriors are generalised Seifert fibered spaces and their lens space surgeries, extending work of Darcy-Sumners.

Biologically then, this classification is endowed with a distance that determines how many protein reactions of a particular type (corresponding to steps of a specified size) are needed to proceed from one local conformation to another. We conclude by discussing a variety of biological applications of this categorisation.

M.Farber: Topological spaces and manifolds are commonly used to model configuration spaces of systems of various nature. However, many practical tasks, such as those dealing with the modelling, control and design of large systems, lead to topological problems having mixed topological-probabilistic character when spaces and manifolds depend on many random parameters. In my talk I will describe several models of stochastic algebraic topology. I will also mention some open problems and results known so far.

J. Brodzki: Coarse geometry provides a very useful organising point of view on the study of geometry and analysis of discrete metric spaces, and has been very successful in the context of geometric group theory and its applications. On the other hand, the work of Carlsson, Ghrist and others on persistent homology has paved the way for applications of topological methods to the study of broadly understood data sets. This talk will provide an introduction to this fascinating topic and will give an overview of possible interactions between the two.