Exact Combinatorics with Applications in Physics

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LOIC FOISSY, Universite de Reims, France
Systems of Dyson-Schwinger equations

In QFT, the propagators satisfy a Dyson-Schwinger system in a Hopf algebra of Feynman graphs. These systems can be lifted to the Hopf algebra of decorated rooted trees with the help of grafting operators. It turns out that in physical cases, the subalgebra generated by the solution of this system is Hopf,a result false in general. We shall give a complete description of Dyson-Schwinger systems with this properties, as well as the associated Lie algebras.

PHILIPPE NADEAU, University of Vienna, Austria.
Combinatorics of Fully Packed Loop configurations

Fully Packed Loop configurations (FPLs) are particular subgraphs of a finite square grid which appeared first in statistical mechanics. From a mathematical perspective, FPLs exhibit a rich combinatorial structure and possess many surprising enumerative properties. The goal of this talk is to present this combinatorial aspect of FPLs and its relation to statistical physics.

CHRIS SOTEROS, University of Saskatchewan
Entanglement Complexity for Polygons in a Lattice Tube

Self-avoiding polygons on $\mathbb{Z}^3$ are the standard statistical mechanics lattice model for ring polymers in dilute solution. Exact combinatorics for this model is notoriously challenging. If the polygons are confined to an infinite rectangular lattice tube, however, exact combinatorics is more accessible due to the one-dimensional nature of the tubular sublattice. In this talk I will review transfer-matrix results about the entanglement complexity (knotting and linking) of polygons in a lattice tube.

STU WHITTINGTON, University of Toronto
Directed walk models of polymers

Directed walks such as Dyck and Motzkin paths are useful models of polymer adsorption and they can be adapted to model the way in which the polymer desorbs under the influence of a force. Under certain solvent conditions polymers can collapse to a compact ball. This transition can be modelled by partially directed walks and the model can be adapted for the case where a force is applied. Recent progress will be discussed.

KAREN YEATS, Simon Fraser University
Spanning forest polynomials and Feynman graph denominators

If we take a Feynman integral in Schwinger parametric form and integrate one variable at at time then the denominators have a natural combinatorial interpretation in terms of spanning forest polynomials. I will discuss this setup and what insight this perspective brings.