TECHNISCHE UNIVERSITÄT WIEN

INSTITUT FÜR THEORETISCHE PHYSIK
WIEDNER HAUPTSTRASSE 8-10, 1040 WIEN

INVITATION

Seminar for Theoretical Physics

Anze Bozic

Institut "Jožef Stefan", Ljubljana

„Scaling properties of RNA as a branched polymer“

D. Vaupotič[1], A. Rosa[2], L. Tubiana[3], and A. Božič[1]

[1]*Department of Theoretical Physics, Jožef Stefan Institute, Ljubljana, Slovenia*
[2]*Scuola Internazionale di Studi Avanzati (SISSA), Trieste, Italy*
[3]*Department of Physics, University of Trento, Trento, Italy*

Formation of base pairs between the nucleotides of an RNA sequence gives rise to a complex and often highly branched RNA structure. While numerous studies have demonstrated the functional importance of the high degree of RNA branching—for instance, for its spatial compactness or interaction with other biological macromolecules—RNA branching topology remains largely unexplored. We use the theory of randomly branching polymers to explore the scaling properties of RNAs by mapping their secondary structures onto planar tree graphs. Focusing on random RNA sequences of varying lengths, we determine the two scaling exponents related to their topology of branching. Our results indicate that ensembles of RNA secondary structures are characterized by annealed random branching and scale similarly to self-avoiding trees in three dimensions. We further show that the obtained scaling exponents are robust upon changes in nucleotide composition, tree topology, and folding energy parameters. Finally, in order to apply the theory of branching polymers to biological RNAs, whose length cannot be arbitrarily varied, we demonstrate how both scaling exponents can be obtained from the distributions of the related topological quantities of individual RNA molecules with fixed length. In this way, we establish a framework to study the branching properties of RNA and compare them to other known classes of branched polymers. By understanding the scaling properties of RNA related to its branching structure we aim to improve our understanding of the underlying principles and open up the possibility to design RNA sequences with desired topological properties.

Date: **on Tuesday the 20th at 10:00**

Location: Seminar Room (Freihaus, gelber Bereich, 3. Stock DB03E11)