**Abstract:**

The planar Ising model is one of the most classical models in statistical mechanics, which has demonstrated both theoretical and experimental relevance. Thanks to remarkable integrability properties, it can be understood at an unparalleled degree of precision and continuous progress has been made during the last eighty years, that allowed one to gain mathematical insight into the nature of deep physical processes.

A particularly exciting connection between critical statistical mechanics models and conformally invariant quantum field theories was conjectured about forty years ago, suggesting the emergence of beautiful algebraic and geometric structures at large scales.

For the 2D Ising model, we are now very close to a rigorous understanding of this connection, thanks to the great progress in rigorous statistical mechanics that occurred in the last fifteen years (in particular the introduction of SLE curves and the development of discrete complex analysis). I will explain what the connection is, how it can be understood in terms of combinatorics, complex analysis, stochastic processes and representation theory, and what are the new objects that we come up with.

Based on joint works with S. Benoist, D. Chelkak, H. Duminil-Copin, K. Izyurov, F. Johansson-Viklund, A. Kemppainen, K. Kytölä and S. Smirnov