Recent advances in 2D Yang–Mills theory

Thierry Lévy
Sorbonne Université, Paris
thierry.levy@sorbonne-universite.fr

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From a probabilistic point of view, the main object of Yang–Mills theory is the construction of a finite measure on a space of connections over a base manifold. This measure is heuristically described as the Gibbs measure associated with the Yang–Mills energy functional, and its main concrete manifestation is a stochastic process indexed by loops on the base manifold, taking its values in a compact matrix group, for instance $\mathrm{SU}(N)$ or $\mathrm{SO}(N)$.

In this talk, I will present recent advances on several aspects of this measure in the 2-dimensional case, where the base manifold is the plane or a compact surface — the only case where the measure was rigourously defined so far.

I will note assume any previous familiarity with the Yang–Mills measure and will start by explaining what it is.

Then I will briefly report on Ilya Chevyrev's recent and important work on distributional spaces of connections, and its application, in collaboration with Ajay Chandra, Martin Hairer and Hao Shen, to the study of the Yang–Mills heat equation with the tools of regularity structures.

Finally, I will give a more detailed presentation of the recent progress in the understanding of the so-called master field, that is, of the large N limit of the partition function of the model and of the measure itself, based on work by Antoine Dahlqvist, Bruce Driver, Franck Gabriel, Brian Hall, Todd Kemp, Thibaut Lemoine, Mylène Maïda, James Norris, and myself.