Introduction to Integrability

Summer Term 2019 (starting April 17)

Lecture: Wednesdays 10-12 (room 269)
Exercise Class: Tuesdays 10-12 (room 1101/F142) **Lecturer:** Till Bargheer

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Among all physical systems, typically only the very simplest can be solved exactly. This is true for classical as well as quantum mechanical systems. Integrable models are an exception: They possess extended symmetries that, in spite of (infinitely) many degrees of freedom, allow for an exact description of the relevant physical observables. They hence provide a unique window into physical regimes that are hardly accessible by other methods. Integrable models appear in classical mechanics, quantum mechanics, field theory (classical and quantum), and statistical mechanics. More recently, integrability has led to a lot of progress in the context of the AdS/CFT duality among superconformal field theory and string theory.

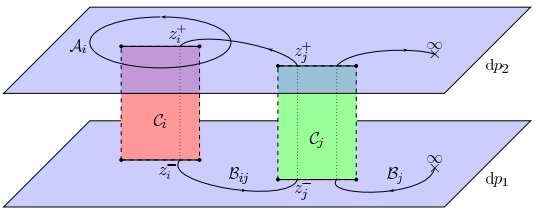
The aim of this lecture is a basic introduction to the theory of integrable models as well as the associated mathematical structures and methods, and the exposition of selected examples.

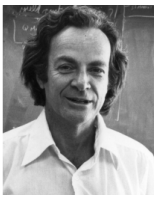
For Master students and everyone interested!

Recommended prerequisites: Classical mechanics, quantum theory, (statistical physics). Enthusiasm for mathematical structures in theoretical physics!

List of Topics (tentative, will be adapted during the course):

1. Integrable Mechanics
2. Structures of Classical Integrability
3. Integrable Field Theory
4. Integrable Spin Chains
5. Quantum Integrability
6. Quantum Inverse Scattering Method
7. Yang–Baxter Equation & Quantum Algebra
8. Integrable Statistical Mechanics
9. Integrability in Gauge and String Theory





"I got really fascinated by these $(1+1)$-dimensional models that are solved by the Bethe ansatz and how mysteriously they jump out at you and work and you don't know why. I am trying to understand all this better."
R. P. Feynman 1988