Introduction to Integrability

Lecture Slides, Chapter 0

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Introduction to Integrability

Overview

- Peculiar feature of some theoretical physics models.
- Makes calculations feasible → (complete) solvability
- map models to problems in complex funct. analysis
- hidden symmetry enhancement
- absence of chaotic motion
- colourful mixture of theoretical physics & maths.
- a lot of fun

Integrable Models

- Many of the simple models of classical mechanics.
  - Free particle, HO, spinning top, Kepler problem / hydrogen.
- 1+1 dimension (1 space, 1 time)
  discrete space: lattice / continuous space: field
  - Korteweg-de Vries (KdV) eq.
  - sine Gordon
  - Einstein Gravity (2D)
  - sigma models on coset spaces
  - classical magnets (1D)
  - string theory
- Quantum Mechanical models, QFT (1+1 dim)
- Statistical Mechanics (vertex models)
- AdS/CFT correspondence, higher dim large-N YM.

Prerequisites

- Classical analytical Mechanics
- (classical) Fields
- Algebra, Groups (QM)
- Complex Functional Analysis

References

- many books on integrable models