

Target group: PhD students in Mathematics or/and theoretical Physics.

Course Title:

Introduction to Batalin-Vilkovisky formalism and applications

Extend: 2 hours per week, 15 weeks, 5 ECTS credits

Aims The aim of the course is to introduce students to the Batalin-Vilkovisky formalism, and some of its applications to topological field theory. In particular, we aim to cover the following introductory topics:

- Introduction to Supergeometry and graded Geometry
- Odd symplectic manifolds, half-densities, BV Laplacian
- Gauge fixing, BV integrals, fiber integrals

Depending on the available time and interest of the audience, some of the following topics will also be covered:

- Perturbative quantization, Feynman diagrams, Faddeev-Popov and BRST formalism
- Chern-Simon's theory and topological invariants
- AKSZ construction: BF theory, Poisson Sigma Model, A- and B models

Synopsis The Batalin-Vilkovisky formalism is a way to study field theories with (possibly degenerate) symmetries. Since its inception by Batalin and Vilkovisky in the early 80's, it has been studied in detail both by physicists and mathematicians. We will mainly concentrate on the field-theoretic aspects of the BV formalism. Here one is interested in the action functionals with (possibly degenerate) symmetries. The BV formalism provides, among other things, a way to resolve those symmetries. Mathematically, one embeds the field theory into an odd symplectic manifold. On such manifolds one has a canonical cohomological operator on the half-density bundle, known as the BV Laplacian. A main result is that integrals of closed half-densities are constant along homotopic families of Lagrangians. In the field-theoretic context, this implies independence of the gauge fixing.

Evaluation method: The evaluation will be based on a one-hour presentation by each student in class (using the hours allocated for the course) on a topic related to the course. The lecturer as well as an internal censor will be present to evaluate the presentation and ask the student questions.

Teaching method In person lectures

Responsible lecture(s) Jørgen Ellegaard Andersen and Konstantin Wernli

Literature [1] Quantum Field Theory: Batalin–Vilkovisky Formalism and Its Applications