Titles and Abstracts for "A Gauge Summer with BV", September 6-10, Scalea

Iakovos Androulidakis: "Coordinates for non integrable Lie algebroids"

The problem we address in this talk is the attachment of a C*-algebra to a non-integrable algebroid. As shown in the case of singular foliations, a C*-algebra can be attached to a diffeological groupoid, whose coordinates are in the form of bi-submersions with varying dimension. In this talk, we will explain the notion of bi-submersion and give the explicit construction of coordinates as such for the Weinstein groupoid of a non-integrable Lie algebroid.

Glenn Barnich: "Photons & gravitons in a Casimir box"

In order to study finite size effects for gauge and gravitational fields, we consider the boundary conditions imposed on the electromagnetic field by the simplest possible, physically meaningful box consisting of two parallel, perfectly conducting metal plates:

(i) By using Hamiltonian BFV methods, we show that the computation of the partition function reduces to that of a real massless scalar field with periodic boundary condition on an interval of double the distance of the plates.

(ii) The partition function has a temperature inversion symmetry that we promote to full modular covariance by turning on a chemical potential for suitably modified spin angular momentum. In terms of exact analytic expressions, one goes from an Epstein zeta function to a real analytic Eisenstein series.

(iii) At low temperature, the leading contribution to the entropy scales like the area of the plates. In terms of micro-states, this contribution is shown to originate from photons that propagate parallel to the plates.

(iv) After defining perfectly conducting boundary conditions in linearized general relativity, these results generalize directly to the case of gravitons.

Francesco Bonechi: "Diagonalization of the Nijenhuis tensor from invariant polynomials"

Motivated by the problem of quantization of the symplectic groupoid we study a class of bihamiltonian systems defined on compact hermitian symmetric spaces. Indeed, a Poisson Nijenhuis (PN) structure defines a (singular) real polarization of the symplectic groupoid integrating any of the Poisson structures appearing in the bihamiltonian hierarchy. Despite its singularity, this polarization leads to the quantization of complex projective spaces. We will discuss in some detail a way to discuss this polarization in terms of invariant polynomials of a certain Thimm chain of subalgebras. This approach works for the classical cases; time permitting, I will discuss some partial results about the exceptional cases.

Giovanni Canepa: The reduced phase space of General Relativity

In this talk I will present some results about the construction of the reduced phase space of the Palatini–Cartan theory of General Relativity. A particular focus will be given to light-like boundaries and the difference of this case to the space- and time-like ones. The method used, described by Kijowski and Tulczijew, is particularly interesting since it is then possible to pass from the reduced phase space to the BFV formulation of the theory in a simple way. This is a joint work with A. S. Cattaneo, M. Schiavina and M. Tecchiolli.

Roberta Iseppi: The BV formalism for U(n)-gauge theories in the framework of NCG

In this talk we will analyze a class of U(n)-gauge theories, naturally appearing in the context of noncommutative geometry, as induced by finite-dimensional noncommutative manifolds, that is, by finite spectral triples. After having described the construction of the BV-extended theories for these models via resolution of the Jacobian ideal, we will explain how not only the BV-extension process but also the induced BV-BRST complexes find an interesting geometric description in the world of noncommutative geometry, in terms of real spectral triples and their associated Hochschild complexes.

Florian Naef: Reidemeister torsion in configuration spaces and string topology

There are several approaches on how to identify Reidemeister torsion with the partition function of BF theory, going back to Schwarz for an analytic approach, and more recently to Cattaneo, Mnev and Reshetikhin for a cellular approach. Perturbatively, one should be able to obtain said partition function from the "universal" AKSZ partition function, which in turn gives rational models for configuration spaces of points as shown by Campos-Willwacher/Idrissi. I will explain how to directly extract (a version of) Reidemeister torsion from the configuration space of two points. Moreover, we will see that the string coproduct as defined by Chas-Sullivan depends (generally non-trivially) on the Reidemeister torsion. This is based on joint work with Pavel Safronov.

Kasia Rejzner: BV-BFV meets perturbative AQFT

In this talk I will report on the progress in incorporating the BV-BFV formalism into the perturbative algebraic quantum field theory (pAQFT) framework. I will focus on the example of QED and how the BV-BFV allows one to understand the soft modes. This is a joint project with Michele Schavina.

Ivo Sachs: "QFT with Stubs"

In string field theory there is a canonical way to regularise the BV-Laplacian but an explicit verification of the quantum BV-equation is cumbersome. In field theory there does not appear to be a canonical regularization of the BV-Laplacian but the calculation of anomalies is generally simple by verifying Ward-identities rather than the quantum BV-equation. This talk is an exercise of calculating the (violation of) quantum BV-equation in field theory using a string-inspired regularisation with stubs. I will then discuss possible applications to string theory.

Michele Schiavina: BV-BFV approach to General Relativity

The BV-BFV formalism is a combination of the BV approach to quantisation of Lagrangian field theories with local symmetries and the BFV approach to

quantisation of constrained Hamiltonian systems. It aims to assign compatible bulk-boundary cohomological data to a Lagrangian field theory on a manifold with boundary (and higher codimension strata), in view of a perturbative quantisation scheme that is compatible with cutting and gluing.

General Relativity (GR), seen as a field theory, is a very important example to phrase within this setting, and one in which interesting new insight and complications emerge already at the classical level.

In this talk I will present a summary of investigations on GR within the BV-BFV formalism, as well as other diffeomorphism-invariant theories, which have given access to rich and nontrivial information about the boundary structure of gravitational models. However, I will argue that the featured examples present unexpected complications for the program of quantisation with boundary (and higher strata).

Indeed, I will show how the BV-BFV construction provides a filter to refine the notion of classical equivalence of field theories, which distinguishes theories in terms of their bulk-boundary behaviour, suggesting that some realisations — among the class of classically equivalent ones—may be more suitable for quantisation with boundary. This allows us to differentiate between, e.g., metric and coframe gravity as well as different string theory models and their 1d analogues.

Simone Speziale: "Charge bracket and the Einstein equations"

Boundaries provide a context where gauge symmetries acquire an observable status, and covariant phase space methods can be used to construct non-zero charges that act as canonical generators of the symmetries. Closure of the algebra of charges is however a non-trivial property in the presence of gravitational radiation, which effectively makes the system open and not conservative. We will present the Barnich-Troessaert bracket and a recent slight generalization as a solution to this problem, and show how closure of the algebra is in direct relation with satisfying Einstein's equations.

Fridrich Valach: G-algebroids

Motivated by some ideas coming from string and M-theory, I will introduce a class of structures, known as G-algebroids. Important special cases include

Lie and Courant algebroids, as well as their cousins appearing in exceptional generalised geometry. Focusing on the latter case, I will discuss a classification result and an application of the theory to the study of consistent truncations and of the recently introduced Poisson-Lie U-duality. This is a joint work with Mark Bugden, Ondrej Hulik, and Daniel Waldram.

Donald Youmans: "Renormalization group flow of Chern-Simons boundary conditions"

In this talk I will talk about Chern-Simons theory defined on a 3d ball with (generalized) chiral boundary conditions. While classically this class of boundary conditions leaves the theory conformally invariant, on the quantum level, the theory develops a Weyl anomaly. We will present a natural SL(2,C)-invariant propagator and use it to compute this anomaly and the associated RG flow perturbatively up to 1-loop.

Maxim Zabzine: Equivariant BV formalism

I will describe the equivariant extension for the Batalin-Vilkovisky formalism for the gauge theories and in particular the AKSZ construction for such extension. As an example, I will consider the equivariant Donaldson-Witten theory within this formalism. If time allows, I may consider other examples.