

Women at the Intersection of Mathematics and High Energy Physics

February 18-20, 2019 - Villa Battelle (UNIGE)

Topical talks

1. *Symmetries and Duality*

Francesca ARICI

Title:

Sphere bundles and Gysin sequences: from topology to mathematical physics

Abstract:

Sphere bundles were central to the development of differential geometry and algebraic topology. In mathematical physics, they naturally appear in the study of gauge theories, and in string theory in the phenomenon of T-duality. In this talk I will describe their history and more recent developments, including work in progress concerning a description of sphere bundles within the setting of operator algebras.

Iuliya BELOSHAPKA

Title :

Twistor approach to harmonic 2-spheres in the loop space

Abstract :

Atiyah's theorem establishes a bijection between the moduli space of G -instantons on R^4 and the space of based holomorphic 2-spheres in the loop space ΩG of a gauge group G . There is a conjecture (due to A. Sergeev) which asserts that there should exist a bijection between the moduli space of Yang-Mills G -fields on R^4 and space of based harmonic 2-spheres in the loop space ΩG . In this talk we will discuss this conjecture and a twistor approach to harmonic 2-spheres in the loop space ΩG .

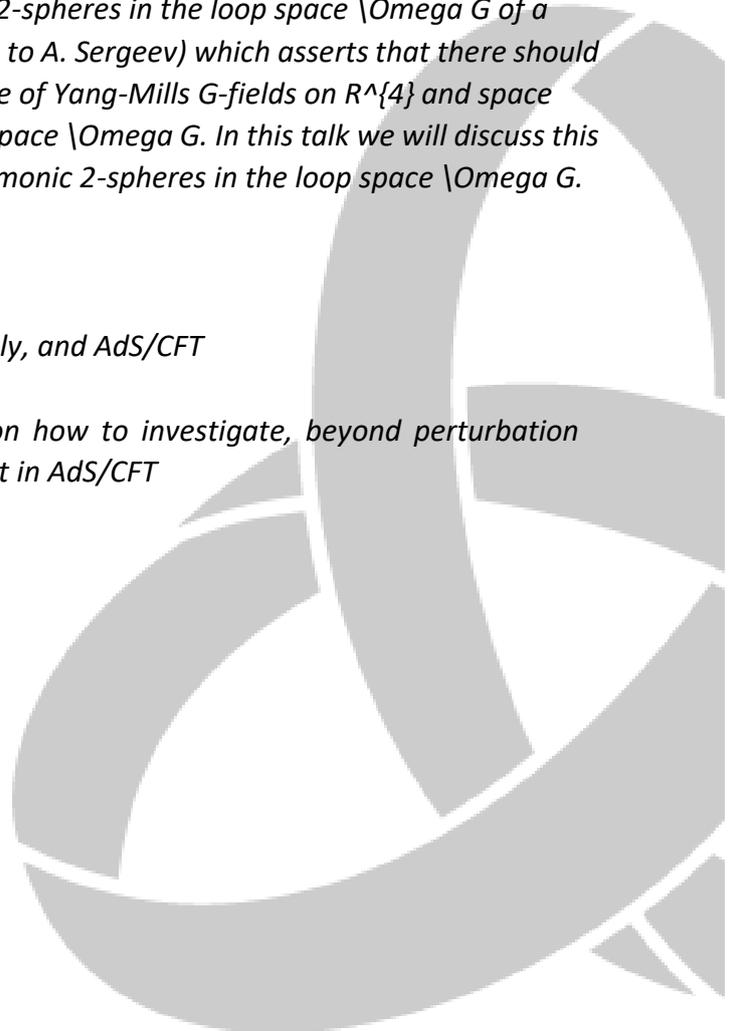
Valentina FORINI

Title :

Superstring world-sheet non-perturbatively, and AdS/CFT

Abstract:

I will present challenges and progress on how to investigate, beyond perturbation theory, worldsheet sigma-models relevant in AdS/CFT



2. Topological, algebraic and geometric invariants

Cristina DIAMANTINI

Title:

Superinsulator: the physics of confinement realised in a new topological state of matter

Abstract:

I will show that superinsulators, a new topological state of matter predicted by my collaboration and observed in the critical vicinity of the superconductor-insulator transition (SIT), realize a single color version of QCD, as imagined by 't Hooft already 40 years ago in a Gedankenexperiment to explain confinement. Cooper pairs play the role of quarks localized within hadrons and are linearly confined by electric field strings dual to magnetic vortices in superconductors. This confinement holds Cooper pairs together and leads to infinite resistance. The SIT appears thus as a material realization of the field-theoretical S-duality in its simplest form. The nature of the phases around the superconductor-insulator transition (SIT) is completely determined by charge-vortex topological interactions embodied by the Aharonov-Bohm/Aharonov-Casher (ABC) phases they acquire when encircling one another, independently of all details about material parameters and disorder. The effective field theory that describes this topological phase of matter is a mixed Chern-Simons field theory in (2+1) dimensions and a BF theory in (3+1).

Anna LACHOWSKA

Title:

The small quantum group and the non-semisimple fusion.

Abstract :

Understanding the structure of the center $z_q(g)$ of the small quantum group $u_q(g)$ at a root of unity is important for the study of the fusion categories and CFTs associated with this algebra. I will review recent progress in the understanding of the structure of $z_q(g)$ and its symmetries.

This is a joint work with Qi You (Caltech).

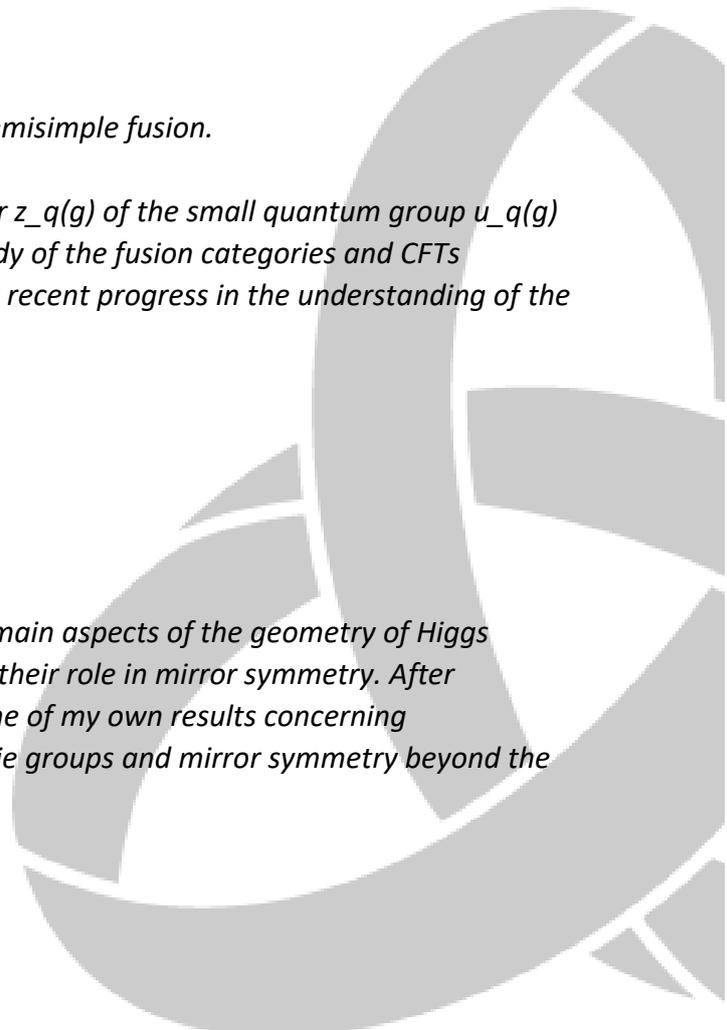
Ana PEON-NIETO

Title:

Hitchin systems in geometry and physics

Abstract :

In this talk I will go through some of the main aspects of the geometry of Higgs bundles focusing on Hitchin systems and their role in mirror symmetry. After introducing the basics, I will mention some of my own results concerning abelianization of Higgs bundles for real Lie groups and mirror symmetry beyond the generic locus.



3. *Locality and singularities*

Ariane CARRANCE

Title.

Quantum spacetime and random colored trisps

Abstract :

In the spirit of matrix models in dimension 2, colored tensor models are an approach to quantum gravity for higher dimensions: they describe spacetime as a probability distribution on some discrete topological spaces, called colored trisps. To obtain a continuous spacetime out of this description, it is crucial to find families of such distributions that have interesting scaling limits. I will present the formalism of colored trisps and colored tensor models, and state the major results of the domain, before talking about some random models of colored trisps that I have studied in this search for a continuum limit.

Reiko TORIUMI

Title:

The gravitational Wilson loop and non-Abelian Stokes' theorem

Abstract:

Finding suitable diffeomorphism-invariant observables to probe gravity at the Planck scale is essential in quantum gravity. The Wilson loop of the 4-dimensional Christoffel connection is a potentially interesting ingredient for the construction of such an observable.

We have investigated to what extent and what form of curvature information of the underlying spacetime may be extracted from Wilson loops through a Stokes' theorem-like relation. We present an expression for the conservation of geometric flux as the quantity related to the gravitational Wilson loop. This expression is surface-independent and it holds for a certain class of manifolds with global symmetries.

