Plenary Talks

The Gribov problem in noncommutative quantum field theory

Patrizia Vitale (Università degli Studi di Napoli Federico II, Italy)

The non trivial topology of the space of physical gauge connections for non Abelian gauge theories manifests itself in the so called “Gribov ambiguity”, essentially the impossibility of choosing a global section in the principal bundle of gauge connections when the gauge group is non-Abelian. The problem is analyzed in the context of noncommutative gauge theory where, already for the gauge group $U(1)$, Gribov copies appear due to space-time noncommutativity. This is a genuine effect of noncommutative geometry which disappears when the noncommutative parameter vanishes. A similar phenomenon manifests in noncommutative scalar field theory, where local automorphisms of the star product give rise to Gribov-like copies.

Vaismann manifolds and Hard Lefschetz isomorphism

Ivan Yudin (Universidade de Coimbra, Portugal)

It is well known that the global scalar product on the space of $k$-forms in an oriented compact Riemannian manifold $M$ of dimension $m$ induces an isomorphism between the $k$th de Rham cohomology group $H^k(M)$ and the dual space of the $(m-k)$th de Rham cohomology group $H^{m-k}(M)$. So, using that the dimension of the de Rham cohomology groups is finite, we deduce the Poincaré-duality: the dimension of $H^k(M)$ is equal to the dimension of $H^{m-k}(M)$.

In some special cases, one can define a canonical isomorphism between the vector spaces $H^k(M)$ and $H^{m-k}(M)$. For instance, if $M$ is a compact Kähler manifold of dimension $m = 2n$ then, using the $(n-k)$th exterior power of the symplectic 2-form, one obtains an explicit isomorphism between $H^k(M)$ and $H^{m-k}(M)$.

The class of locally conformally Kähler manifolds is a natural extension of the class of Kähler manifolds and one of its most studied subclasses is that of Vaisman manifolds. In this talk I will explain how one can establish a canonical isomorphism between $H^k(M)$ and $H^{m-k}(M)$ for Vaisman manifolds.

This is a joint work with Beniamino Cappelletti-Montano, Antonio de Nicola, and Juan Carlos Marrero.

Multi-scale spacetimes, from theory to phenomenology: standard model, gravitational waves and CMB

Gianluca Calcagni (IEM-CSIC, Spain)

We review the motivations and main ingredients of multi-scale theories, where the geometry of spacetime changes with the probed scale and shows the typical properties of multi-fractals, as well as a discrete structure at Planckian scales. This paradigm, alternative to popular quantum-gravity scenarios, predicts a characteristic phenomenology that is tested by a number of experiments ranging from particle physics to astrophysics and cosmology. Experiments place tight constraints on the fundamental scales of the geometry.