

**Workshop on Algebraic
Geometry and Physics 2025.
Moduli Spaces in
(Super)Geometry and
Mathematical Physics. A
celebration of Ugo Bruzzo's
70th birthday**

Report of Contributions

Contribution ID: 1

Type: **not specified**

Automorphisms of quartic surfaces and Cremona transformations

Tuesday, 7 October 2025 15:00 (1 hour)

In this talk, I will address the following question, attributed to Gizatullin: “Which automorphisms of a smooth quartic surface in projective 3-space are restrictions of Cremona transformations of the ambient space?” Corti and Kaloghiros have introduced a general framework that is extremely useful for approaching this problem, namely, a special version of the Sarkisov program for Calabi-Yau pairs. I will report on recent progress on Gizatullin’s problem obtained using this theory, in collaborations with Alessio Corti and Alex Massarenti, and with Daniela Paiva and Sokratis Zikas.

Presenter: ARAUJO, Carolina (IMPA, Brazil)

Contribution ID: 2

Type: **not specified**

Non-Kähler Hodge–Lefschetz theory and the Bianchi identity

Friday, 10 October 2025 11:00 (1 hour)

Being Kähler imposes severe constraints on the cohomology of compact complex manifolds such as the Hard Lefschetz property, and the question of how far this generalises beyond the class of Kähler manifolds has been of great interest for a while. In this talk, I shall report on ongoing joint work with Mario García Fernández and Raúl González Molina that abstracts out the definition of a variation of Hodge–Lefschetz structure and provides evidence that, under certain natural assumptions, such a structure exists more generally on distinguished subspaces within moduli spaces of Bismut–Ricci-flat metrics that are pluriclosed up to source terms. In particular, these distinguished subspaces may be regarded as replacements for the Kähler cone, with affine structure modelled on a subspace of the $(1,1)$ Aeppli cohomology of the compact complex manifold.

Presenter: SAHA, Arpan (Universidade Estadual de Campinas, Brazil)

Contribution ID: 3

Type: **not specified**

Moduli of stable super maps

Monday, 6 October 2025 09:30 (1 hour)

We construct the moduli of stable supermaps as an algebraic superstack with superschematic and separated diagonal. We prove that its bosonic reduction is an affine linear scheme over the stack of stable spin maps, so that it is not proper except in a few particular cases. We also compute the virtual dimension of the moduli superstack of stable supermaps, and prove that it coincides with previous calculations when the target of the supermaps is bosonic.

Presenter: HERNÁNDEZ RUIPÉREZ, Daniel (Universidad de Salamanca, Spain)

Contribution ID: 4

Type: **not specified**

On the Noether-Lefschetz theory in projective toric orbifolds

Tuesday, 7 October 2025 11:00 (1 hour)

In 2012, Bruzzo and Grassi proved a Noether-Lefschetz theorem for toric varieties, which claims that for a $(2k+1)$ -dimensional projective toric orbifold with suitable conditions on a very general quasi-smooth hypersurface X , each (k, k) -cohomology class on X comes from the ambient toric variety. The Noether-Lefschetz locus is the locus of quasi-smooth hypersurfaces with the same degree such that there exists a (k, k) -cohomology class that does not come from the ambient toric variety. In this talk, I will present the main results about the Noether-Lefschetz loci in toric varieties based on my joint work with Prof. Ugo Bruzzo in recent years.

Presenter: MONTROYA, William D. (Universidade Estadual de Campinas, Brazil)

Contribution ID: 5

Type: **not specified**

The Hilbert scheme of points and its motive

Thursday, 9 October 2025 11:00 (1 hour)

The Hilbert scheme of points on a quasi-projective variety is a classical object in algebraic geometry. However, its geometry is nowadays still not completely accessible. On the other hand, the motive of a variety X is an invariant attached to X carrying a lot of information about its geometry, and it is considered as a universal Euler characteristic. In a joint project with Monavari, Moschetti and Ricolfi we give general formulas to compute the motive of the Hilbert scheme of points, provided the knowledge of a finite amount of data (that we give explicitly in some cases). In my seminar I will present our formulas and I will show many applications.

Presenter: GRAFFEO, Michele (Sissa, Italy)

Contribution ID: 6

Type: **not specified**

Coherent Systems on Surfaces

Friday, 10 October 2025 15:00 (1 hour)

Let X be a smooth, irreducible, projective surface. A coherent system on X is a pair (E, V) where E is a coherent sheaf on X and V is a finite-dimensional vector space. Associated to coherent systems there is a notion of stability that depends on a parameter $\alpha \in \mathbb{Q}[m]$. In this talk, we describe the moduli space of coherent systems for $\alpha \gg 0$, present topological and geometric properties of this moduli space, and describe the structure of chambers and walls for coherent systems on the projective plane when $\dim(V) = 2$.

This is joint work with L. Costa, I. Macías-Tarrío, and a joint work with O. Mata-Gutiérrez, and H. Torres-López.

Presenter: ROA-LEGUIZAMÓN, Leonardo (Universidade Estadual de Campinas, Brazil)

Contribution ID: 7

Type: **not specified**

Splitting of supervector bundles on projective superspaces

Wednesday, 8 October 2025 11:00 (1 hour)

In this talk, we will introduce basic concepts of superalgebraic geometry and explore why certain classical foundational results, such as the Birkhoff-Grothendieck splitting criterion, do not extend naturally to the supergeometric setting. We then present a splitting criterion for supervector bundles and give some examples of supervector bundles with vanishing cohomology that do not split.

Joint work with Ugo Bruzzo (SISSA).

Presenter: ALMEIDA, Charles (Universidade Federal de Minas Gerais, Brazil)

Contribution ID: 8

Type: **not specified**

Linear data for the nested Hilbert scheme of points on affine spaces and varieties

Monday, 6 October 2025 16:30 (1 hour)

In this talk we realize the nested Hilbert scheme of points on affine spaces and varieties as quiver varieties. In addition, we provide a schematic construction to a set-theoretical result concerning the nested Hilbert schemes of points on $\mathbb{A}^2$ with quotients supported on curves, provided by Santos; we compute interesting examples and an explicit formula for the tangent space to these latter schemes. This construction generalizes previous work of Jardim, von Flach and Lanza, about the nested Hilbert schemes of points on $\mathbb{A}^2$ and also of Henni and Jardim, about the Hilbert schemes of points on $\mathbb{A}^n$, for $n \geq 3$.

Presenter: DOS SANTOS, Pedro H. (Universidade Federal de Pernambuco (UFPE), Brazil)

Contribution ID: 9

Type: **not specified**

Moduli of framed sheaves on Hirzebruch surfaces

Monday, 6 October 2025 11:00 (1 hour)

In this talk, I shall survey three papers devoted to the study of moduli spaces of framed sheaves on Hirzebruch surfaces, two of which were written in collaboration with Ugo Bruzzo. These contributions pursue a common objective: the construction of a quiver-theoretic description of such moduli spaces, starting from the monadic description previously established by Bartocci, Bruzzo, and Rava. To date, this objective has been fully realized only in the rank-1 case—corresponding to Hilbert schemes of points on suitable line bundles over $\mathbb{P}^1$ —and in the so-called minimal case, where minimality refers to a bound on the numerical invariants of the sheaves that guarantees the non-emptiness of the moduli space. In the concluding part of the talk, I will discuss possible directions for future research on the subject.

Presenter: LANZA, Valeriano (Universidade Federal Fluminense, Brazil)

Contribution ID: 10

Type: **not specified**

Higgs Grassmannians

Monday, 6 October 2025 15:00 (1 hour)

We consider a Higgs bundle (E, ϕ) . Its Higgs Grassmannians are subschemes of the usual Grassmannian bundles of E that parameterise Higgs quotients of (E, ϕ) . We recall how to define them, present some results about their structure, and explain how they can be used to prove some results about Higgs bundles satisfying a strong semistability condition.

Presenter: GRAÑA OTERO, Beatriz (Universidad de Salamanca, Spain)

Contribution ID: 11

Type: **not specified**

On characteristic classes for bundles on quantum spaces

Tuesday, 7 October 2025 09:30 (1 hour)

We study the quantization of spaces whose K-theory in the classical limit is the ring of dual numbers $\mathbb{Z}[t]/(t^2)$. For a compact quantum space, we give sufficient conditions that guarantee there is a morphism of abelian groups from $K_0 \rightarrow \mathbb{Z}[t]/(t^2)$, compatible with the tensor product of bimodules.

Applications include the standard quantum sphere S_q^2 and a quantum 4-sphere S_q^4 coming from quantum symplectic groups. For the former the K-theory is generated by the Euler class of a monopole bundle while for the latter, the K-theory is generated by the Euler class of the instanton bundle.

Presenter: LANDI, Giovanni (Università degli Studi di Trieste, Italy)

Contribution ID: 12

Type: **not specified**

Cox Gorenstein algebras

Tuesday, 7 October 2025 16:30 (1 hour)

We study G -graded Artinian algebras having Poincaré duality and their Lefschetz properties. We prove the equivalence between the toric setup and the G -graded one. We prove a Hessian criterion in the G -graded setup. We provide an application to toric geometry.

Presenter: GONDIM, Rodrigo (Federal University of Pernambuco, Brazil)

Contribution ID: 13

Type: **not specified**

On the exceptional set of crepant resolutions of abelian singularities

Thursday, 9 October 2025 17:00 (1 hour)

Let G be a finite abelian subgroup of $\mathrm{SL}(n, \mathbb{C})$, and suppose there exists a toric crepant resolution $\phi : X \rightarrow \mathbb{C}^n/G$ of the quotient variety $\mathbb{C}^n/G$. Let $\mathrm{Exc}(\phi) = E_1 \cup \dots \cup E_s$ be the decomposition of the exceptional set of ϕ into irreducible components. In this seminar, I will show that for every i there exists an open subset U_i of X such that $E_i \subset U_i$, and U_i is isomorphic to the total space of the canonical bundle ω_{E_i} of E_i . Furthermore, $X = U_1 \cup \dots \cup U_s$. This contributes to the collection of results aimed at solving a classical problem, i.e., to determine which submanifolds of a complex manifold have a neighborhood isomorphic to a neighborhood of the zero section of their normal bundle.

Presenter: ARCEU FERREIRA, Fábio (Federal University of Rio Grande do Norte, Brazil)

Contribution ID: 14

Type: **not specified**

Towards an algebraic proof for the Codimension One Theorem

Friday, 10 October 2025 09:30 (1 hour)

In 1996, David Cox proved that for a given projective toric variety of dimension n , its homogeneous coordinate ring modulo $n+1$ forms with the same ample degree, that do not vanish simultaneously, must have dimension one in the component of the critical degree of the forms.

This result, known as the Codimension One Theorem, was generalized by Cattani-Cox-Dickenstein and even further by Cox-Dickenstein. We will discuss these generalizations and their geometric ingredients involved in their proofs. We will conclude with an algebraic proof of Cox's theorem in the case of a product of projective spaces.

Presenter: HOLANDA, Rafael (Universidade Federal de Pernambuco, Brazil)

Contribution ID: 15

Type: **not specified**

Enumerative geometry of flag varieties and prime numbers

Wednesday, 8 October 2025 09:30 (1 hour)

Enumerative geometry, as formulated in Gromov–Witten theory, encodes curve-counting information on smooth projective varieties. Such data can be organized in different ways, giving rise to rich geometric structures and invariants, including quantum cohomology and quantum spectra. In the work \emph{G.~Cotti, “Coalescence Phenomenon of Quantum Cohomology of Grassmannians and the Distribution of Prime Numbers,” IMRN, 2022}, an unexpected connection was observed between the quantum cohomology of Grassmannians and the distribution of prime numbers. In this talk, I will present recent progress extending this perspective to the enumerative geometry of more general partial flag varieties, highlighting how the relation with prime numbers persists in a broader setting.

Presenter: COTTI, Giordano (Universidade de Lisboa, Portugal)

Contribution ID: 16

Type: **not specified**

Stability conditions for coherent systems on integral curves

Thursday, 9 October 2025 09:30 (1 hour)

In this talk, we briefly introduce stability conditions, which we apply to the category of coherent systems on an integral curve C .

We define Bridgeland stability conditions on its derived category. We also study the semistability of certain objects with respect to these conditions. We use some results we got to address the problem of finding bounds for the dimension of the space of global sections of torsion-free sheaves on C . It's a joint work with Marcos Jardim and Leonardo Roa-Leguizamon.

Presenter: VIDAL MARTINS, Renato (Universidade de Campinas, Brazil)

Contribution ID: 17

Type: **not specified**

On the Factorization of Lucas Polynomials via Lucas Atoms

Thursday, 9 October 2025 15:00 (1 hour)

In 2020, Sagan and Tirrell introduced Lucas atoms, which are irreducible factors of Lucas polynomials. Their main goal was to investigate when certain combinatorial rational functions are actually polynomials. In a joint work with Miska, Murru, and Romeo, we present Lucas atoms in a more natural way than the original definition, providing straightforward proofs of their main properties. Moreover, we fully characterize the p -adic valuations of Lucas atoms for any prime p , thereby answering a question left open by Sagan and Tirrell. Finally, we show that the sequence of Lucas atoms is not holonomic, in contrast to the Lucas sequence, which satisfies a linear recurrence of order two.

Presenter: ALECCI, Gessica (Politecnico di Torino, Italy)

Contribution ID: **18**

Type: **not specified**

Some results on Donagi-Markman cubics for Hitchin systems

Friday, 10 October 2025 16:30 (1 hour)

will review some results on Donagi-Markman cubics (infinitesimal period maps) for the pure and generalised Hitchin system. I will discuss how these fit into the context of special Kaehler geometry, and also will discuss some work in progress. Joint with Ugo Bruzzo.

Presenter: DALAKOV, Peter (American University in Bulgaria, Bulgaria)