III Congresso Brasileiro de Jovens Pesquisadores
em Matemática Pura, Aplicada e Estatística

Curitiba, December 12-14, 2018

Session: Algebraic Geometry

Organized by Abdelmoubine Amar Henni (Universidade Federal de Santa Catarina)
and Valeriano Lanza (Universidade Estadual de Campinas)

Schedule

Wednesday, December 12

9:00 - 9:30	Opening
9:30 - 10:30	Plenary talk 1
10:30 - 11:00	Coffee break
11:00 - 11:50	S. Marchesi
	Nearly free arrangements: a vector bundle point of view
12:00 - 13:30	Lunch
13:30 - 14:30	Plenary talk 2
14:40 - 15:30	K. Iusenko
	Stable representations of posets
15:40 - 16:30	C. A. de Almeida
	Lefschetz properties and power of linear forms
16:40 - 17:10	Coffee break
17:10 - 18:40	Round Table

Thursday, December 13

9:00 - 10:00	Plenary talk 3
10:00 - 10:30	Coffee break
10:30 - 11:20	M. Ravara-Vago
	Nodal separators for codimension one foliations in dimension three
11:20 – 12:00	R. Mossa
	On the Szegö kernel of the disk bundle over polarized manifolds
12:00 - 13:30	Lunch
13:30 - 14:30	Plenary talk 4
14:40 - 15:30	F. Tanturri
	Orbital degeneracy loci
15:40 - 16:30	V. Benedetti
	Zero loci and torus actions: bisymplectic Grassmannians
16:40 - 17:10	Coffee break
17:10 - 17:40	D. A. de Moraes Dantas
	Cremona transformations factoring through projections
20:00 - 0:00	Social dinner

Friday, December 14

9:00 - 10:00	Plenary talk 5
10:00 - 10:30	Coffee break
10:30 - 11:20	A. V. Andrade
	Gaps in the number of generators of monomial Togliatti systems
11:20 - 12:10	A. Contiero
	A Deligne's formula revisited
12:00 - 13:30	Lunch
13:30 - 14:30	Plenary talk 6
14:40 - 15:30	G. Menet
	Global Torelli theorem for hyperkähler orbifolds
15:40 - 16:30	G. Mongardi
	Curve classes on irreducible symplectic manifolds
16:40 - 17:10	Coffee break
17:10 - 18:40	Assembly

Abstracts

1. *Speaker:* **Simone Marchesi**
   Affiliation: Universidade Estadual de Campinas
   Title: **Nearly free arrangements: a vector bundle point of view**

   One of the most famous and interesting conjectures regarding line arrangements (we will restrict to the projective plane case) is the so called Terao's conjecture and, if such conjecture is not true, than the arrangement would be associated to a vector bundle whose jumping locus is related to a 0-dimensional scheme in the projective plane. In this talk we will focus on the case when such scheme is a point, characterizing the associated vector bundles and relating, through examples, this jumping point to the line arrangement. This is a joint work with Jean Vallès (UPPA-France).

2. *Speaker:* **Kostiantyn Iusenko**
   Affiliation: IME-USP
   Title: **Stable representations of posets**

   Representations of finite dimensional algebras can be approached combinatorially via representations of posets (due to L.A. Nazarova and A.V. Roiter) and representations of quivers (due to P. Gabriel). The problem of classifying representations of "most" algebras is wild in a sense that it is as difficult as the problem of classifying representations of free algebras. Nevertheless, one can use geometrical approach by considering the spaces whose points correspond naturally to isomorphism classes of representations. Using standard GIT methods A. King defined the moduli spaces of quiver representations. In this talk we will discuss certain aspects related to study of moduli space of poset representations. We will see that the Euler quadratic form associated with a poset plays significant role here: for calculation of dimension of moduli space and for canonical choice of stability (which is certain analogue of Schofield's characterization of Schurian roots for quiver). Also we plan to discuss the behavior of Coxeter transformations on stable representations.

3. *Speaker:* **Charles Aparecido de Almeida**
   Affiliation: UNICAMP
   Title: **Lefschetz Properties and Power of Linear Forms**

   The study of the presence of Lefschetz properties in Artinian algebras is a topic of great interest in commutative algebra, that has many applications in different fields of mathematics. More precisely, let $A = R/I$ be a Artinian standard graded algebra, with $R = \mathbb{K}[x_1, \cdots, x_n]$ where $\mathbb{K}$ is a field of characteristic zero, we say that A has the *Strong Lefschetz Property* (SLP) or the *Weak Lefschetz Property* (WLP), when the homomorphism induced by the multiplication map $\times L^k : A_{j-k} \to A_j$, of a general linear form L, has maximal rank in all degrees, for any k, or for $k = 1$ respectively. Although it seems a simple problem in linear algebra, it is not clear how one can produce examples of Algebras satisfying those properties. Because of this, it is important to determine for which values of k the multiplication by L^k has maximal rank. In this talk, we will discuss how to use tools from algebraic

geometry to prove that if the ideal I is generated by powers of linear forms, then the homomorphism induced by the multiplication map $\times L^2 : A_{j-2} \to A_j$ has maximal rank in all degrees. (This is a joint work with Aline V. Andrade).

4. *Speaker:* **Marianna Ravara Vago**
   Affiliation: UFSC
   Title: **Nodal separators for codimension one foliations in dimension three**

   Nosso objetivo é estudar a estrutura local do espaço de folhas de um germe de folheação holomorfa singular de codimensão 1 em $C^3, 0$. Após redução de singularidades, o divisor excepcional resultante e o conjunto singular do transformado da folheação devem se comportar de uma determinada maneira, e isto provoca uma distribuição das folhas em uma vizinhança da origem.

5. *Speaker:* **Roberto Mossa**
   Affiliation: USP/IME
   Title: **On the Szego kernel of the disk bundle over polarized manifolds**

   In this seminar we talk about some new results on the vanishing of the log-term in the Fefferman expansion of Bergmann kernel of the disc bundle of the dual line bundle of an ample line bundle over a Kahler manifold (A. Loi, —, F. Zuddas, Ann. Global Anal. Geom. 51 (2017), no. 1, 35-51). As well as some new results on the vanishing of the log term of the Szegö kernel of the corresponding unit circle bundle. These results are related to the classical Ramadanov conjecture and are inspired by the recent work of Z. Lu and G. Tian (Duke Math. J. 125:351-387, 2004). In particular they confirm the conjecture of Lu that affirms that the coefficient a_k of the Tian-Yau-Zelditch expansion of the Kempf distortion function, vanish for $k > n$ if and only if the log-term of the Szegö kernel vanishes.

6. *Speaker:* **Fabio Tanturri**
   Affiliation: Université de Lille
   Title: **Orbital degeneracy loci**

   In a joint project with Vladimiro Benedetti, Sara Angela Filippini, and Laurent Manivel, we introduce a new class of varieties, called orbital degeneracy loci. They are modelled on any orbit closure in a representation of an algebraic group and generalize classical degeneracy loci of morphisms between vector bundles or zero loci of sections. In this talk I will introduce some tools to understand and study this new class of objects; with such techniques, we can exploit our construction to produce several interesting examples of projective varieties, in particular varieties with trivial or negative canonical bundle.

7. *Speaker:* **Vladimiro Benedetti**
   Affiliation: Université Paris Sciences et Lettres
   Title: ***Zero loci and torus actions: bisymplectic Grassmannians***

Zero loci of sections of bundles over Grassmannians can be successfully used to construct interesting varieties: an example is given by the two maximal families of hyper-Kahler manifolds due to Beauville-Donagi and Debarre-Voisin. In this talk I will present a particular class of Fano zero loci, namely bisymplectic Grassmannians. A bisymplectic Grassmannian parametrizes subspaces of a given vector space which are isotropic with respect to a pencil of skew-symmetric two-forms. When the subspaces are of maximal dimension this variety is just a product of rational curves, but in the other cases bysimplectic Grassmannians admit non trivial deformations. Moreover, when the pencil is general, the bisymplectic Grassmannian admits the action of a torus with a finite number of points. This action allows us to use the Bialynicki-Birula cell decomposition in order to study their geometry and cohomology. We will see in the case of bisymplectic Grassmannians of planes how this decomposition is different from that for homogeneous spaces, and how it is possible to use it in order to study the geometry and (equivariant) cohomology of such manifolds.

8. *Speaker:* **Divane Aparecida de Moraes Dantas**
   Affiliation: PUC Minas
   Title: ***Transformações de Cremona que se fatoram por projeções***

Em 2008, D.Avritzer, G. Gonzalez-Sprinberg e I Pan, classificaram as transformações de Cremona de $\mathbb{P}^3$ que se fatoram por projeções de um complexo quadrático de retas de $\mathbb{P}^5$. Tomando duas hiperfuperfície Q_1 e Q_2 suaves em $\mathbb{P}^5$ de tal maneira que $X = Q_1 \cap Q_2$ é suave. Sejam L_1, $L_2 \in X \subset \mathbb{P}^5$ retas disjuntas. Fixado dois 3-planos $\mathbb{P}^3_i$ em $\mathbb{P}^5$, tais que $\mathbb{P}^3_i \cap L_i = \emptyset$ mostraram que a aplicação birracional $T : \mathbb{P}^3_1 \dashrightarrow \mathbb{P}^3_2$, que se fatora por projeções de X com centro L_1 e L_2, é uma transformação de Cremona cubo-cúbica e classificaram : se $L_1 \cap L_2 = \emptyset$, então T é Determinantal e se $L_1 \cap L_2 \neq \emptyset$, então T é de De Jonquières. Pensando se esse resultado poderia ser aplicado em dimnensões maiores, fizemos um análogo ao caso em $\mathbb{P}^4$, tomando $X = Q_1 \cap Q_2 \cap Q_3$ uma interseção completa de três hipersuperfícies quádricas suaves de $\mathbb{P}^7$ contendo dois 2-planos α_1 e α_2, tal que X seja suave. Fixado dois 4-planos $\mathbb{P}^4_i$, tais que $\mathbb{P}^4_i \cap \alpha_i = \emptyset$, i = 1, 2. A aplicação birracional $T : \mathbb{P}^4_1 \dashrightarrow \mathbb{P}^4_2$, a qual se fatora por projeções de X com centro α_1 e α_2, é uma transformação de Cremona de grau 4 com a inversa de grau 4 e classificamos: se $\alpha_1 \cap \alpha_2 = \emptyset$, então T é determinantal, se $\alpha_1 \cap \alpha_2 = L$ uma reta, então T é de De Jonquières e se $\alpha_1 \cap \alpha_2 = p$ um ponto T não é nem determinantal e nem de De Jonquières. Além disso, demos uma caracterização geométrica das transformações de Cremona de $\mathbb{P}^n$ que agem birracionalmente no conjunto dos hiperplanos que passam por um ponto.

9. *Speaker:* **Aline Vilela Andrade**
   Affiliation: UFSCar
   Title: ***Gaps in the number of generators of monomial Togliatti Systems***

Let $I_{d,n} \subset k[x_0, \cdots , x_n]$ be a minimal monomial Togliatti system of forms of degree d. In 2016

Mezzetti and Miró-Roig proved that the minimal number of generators $\mu(I_{d,n})$ of $I_{d,n}$ lies in the interval $[2n + 1, \binom{n+d-1}{n-1}]$. In colaboartion with Almeida and Miró-Roig, we prove that for $n \geq 4$ and $d \geq 3$, the integer values in $[2n + 3, 3n - 1]$ can not be realized as the number of minimal generators of a minimal monomial Togliatti system. We classify minimal monomial Togliatti systems $I_{d,n} \subset k[x_0, \cdots, x_n]$ of forms of degree d with $\mu(I_{d,n}) = 2n + 2$ or $3n$ (i.e with the minimal number of generators reaching the border of the non-existence interval). Finally, we prove that for $n = 4$, $d \geq 3$ and $\mu \in [9, \binom{d+3}{3}] \setminus \{11\}$ there exists a minimal monomial Togliatti system $I_{d,n} \subset k[x_0, \cdots, x_n]$ of forms of degree d with $\mu(I_{n,d}) = \mu$. Joint wok with Charles Almeida and Rosa Maria Miró-Roig.

10. *Speaker:* **André Contiero**
    Affiliation: UFMG
    Title: **A Deligne's formula revisited**

    In the beginning of 70's, P. Deligne computed the dimension of a smoothing component of the formal versal deformation space of a local ring associated to point in a reduced projective curve. In this talk we reprove Deligne's formula by assuming that the projective curve is locally complete intersection. We also formulate a question about an improvement of Deligne's formula by suggesting a possible missing numerical invariant when the reduced curve is monomial. If the answer of our question is positive, we show a consequence in the theory of complete intersection projective monomial curves and also on the dimension of the moduli space of smooth pointed curves with a fixed Weierstrass semigroup. This is a joint work with Jhon E. Vargas (UFMG).

11. *Speaker:* **Gregoire Menet**
    Affiliation: Institut Fourier
    Title: **Global Torelli theorem for Hyperkähler orbifolds**

    Since the Bogomolov decomposition theorem, irreducible symplectic manifolds play an important role in algebraic geometry. They can be considereted as elementary bricks among the Kähler manifolds with a trivial first Chern class. In 2011, Verbitsky has proved a fundamental tool in the field: the global Torelli theorem. The idea is to be able to recover the geometry of the manifold from the Hodge structure of its second cohomology group. An orbifold is a generalization of manifold obtained by gluing quotients of opens of C^n by finite groups. In this talk, we will see, how the global Torelli theorem can be extended to irreducible symplectic orbifolds.

12. *Speaker:* **Giovanni Mongardi**
    Affiliation: Bologna University
    Title: **Curve classes on irreducible holomorphic symplectic manifolds**

    in this talk, we prove the integral Hodge conjecture for one cycles on some (projective) IHS manifolds and discuss its consequences on Fano manifolds related to them. This is joint work with J.C. Ottem.