The conference will take place in ENS de LYON, Site Science (Monod), UMPA, Room 435.

Lundi 11 Décembre :

(1) 9h30-10h : WELCOME OF PARTICIPANTS

(2) 10h00-11h : **Amador Martin Pizarro**, Quotients and equations

Quotients are ubiquitous in Mathematics, and a general question is whether a certain category of sets allows quotients. For the category of definable sets in a given structure, the model theoretic approach is called elimination of imaginaries. For algebraically closed fields, Chevalley's theorem and the existence of a field of definition of a variety imply that a quotient of a Zariski constructible set by a Zariski constructible equivalence relation is again a constructible set. Similar results hold for other classes of fields, such as differentially closed fields.

In this talk, we will focus on separably closed fields of positive characteristic p, and particularly those of infinite imperfection degree. Such a field K has infinite linear dimension over K^p. It is unknown whether the theory $\mathrm{SCF}_{p,\infty}$ of separably closed fields of positive characteristic p and infinite imperfection degree has elimination of imaginaries. In joint work with Martin Ziegler, we will provide a natural expansion of the language to achieve this, by showing that the theory $\mathrm{SCF}_{p,\infty}$ is equational. Equationality, introduced by Srour, and later considered by Srour and Pillay, is a generalisation of local noetherianity. We will present the main ideas of the proof, without assuming a deep knowledge of model theory.

(3) 11h15-12h15 : **Dario Garcia**, Pseudofinite structures, simplicity and unimodularity

The fundamental theorem of ultraproducts (Los' Theorem) provides a transference principle between the finite structures and their limits. It states that a formula is true in the ultraproduct M of an infinite class of structures if and only if it is true for "almost every" structure in the class, which presents an interesting duality between finite structures and their infinite ultraproducts.

This kind of finite/infinite connection can sometimes be used to prove qualitative properties of large finite structures using the powerful known methods and results coming from infinite model theory, and in the other direction, quantitative properties in the finite structures often induce desirable model-theoretic properties in their ultraproducts. These ideas were used by Hrushovski to apply ideas from geometric model theory to additive combinatorics, locally compact groups and linear approximate subgroups. More examples of this fruitful interaction were given by Goldbring and Towsner who provided proofs of the Szemerédi's regularity lemma and Szemerédi's theorem via ultraproducts of finite structures.

In this talk I will review the main concepts of pseudofinite structures, and present joint work with D. Macpherson and C. Steinhorn where we explored conditions on the (fine) pseudofinite dimension that guarantee good model-theoretic properties (simplicity or supersimplicity) of the underlying theory of an ultraproduct of finite structures, as well as a characterization of forking in terms of decrease of the pseudofinite dimension. I will also present the concept of *unimodularity* (for definable sets) - which is satisfied by both pseudofinite structures and omega-categorical structures - and, if time permits, a result (joint with F. Wagner) about the equivalence between difference notions of unimodularity.

(4) 13h30-14h30 : **Johannes Huisman**, Characteristic numbers and existence of real solutions to systems of polynomial equations

For a given system of polynomial equations satisfying some mild conditions, we introduce a finite sequence of characteristic numbers. We show that if one of them is odd, then the system has a real solution. This is a vast generalization of the elementary fact that a real polynomial in one variable of odd degree has a real zero.

(5) 15h00-16h00 : **Sylvie Paycha**, Evaluating meromorphic functions at poles while preserving locality

Evaluating meromorphic functions at poles is unavoidable when computing Feynman integrals and the main difficulty lies in preserving locality. There are sophisticated methods such as the forest formula or algebraic Birkhoff factorisation à la Connes and Kreimer to make sure locality is preserved. They typically use dimensional regularisation, thus leading to meromorphic functions in one variable.

Instead we use a multiparameter regularisation à la Speer, which leads to multivariate meromorphic functions, our object of study in this talk. We introduce a locality structure on multivariate meromorphic germs with linear poles at zero, which "separates" germs depending on orthogonal sets of variables and call such germs independent of each other. In order to evaluate these germs at the zero pole, we define generalised evaluators at zero which factorise over independent germs and characterise them by means of (decorated) cones using multivariate Laurent expansions. A typical generalised evaluator is obtained by first projecting the germ onto its holomorphic part and then evaluating this projected germ at zero. We shall discuss the underlying multivariate projections and their central role in renormalisation.

This talk is based on joint work (partially in progress) with P. Clavier, L. Guo and B. Zhang.

Mardi :

(1) 9h45-10h45 : **Erwan Brugallé**, Plane tropical cubic curves of arbitrary genus, and generalisation

It has been known for a long time that a tropical curve in R^2 of degree d has genus at most $(d-1)(d-2)/2$. In this talk I will explain how to construct a plane tropical cubic curve of arbitrary genus. In particular, I will resolve the apparent contradiction of the last two sentences. More generally, I will talk about (upper and lower) bounds on Betti numbers of tropical varieties of R^n (and if time permits on tropical Hodge numbers). Generalizing what is written above for cubics, I will show that there is no finite upper bound on the total Betti numbers of projective tropical varieties of degree d and dimension m. This is a joint work with B. Bertrand and L. Lopez de Medrano.

(2) 11h00-12h00 : **Andres Jaramillo Puentes**, Rigid isotopies of degree 5 nodal rational curves in $\mathbb{RP}^2$.

In order to study the rigid isotopy classes of nodal rational curves of degree 5 in $\mathbb{RP}^2$, we associate to every real rational quintic curve with a marked real nodal point a trigonal curve in the Hirzebruch surface Σ_3 and the corresponding nodal real dessin on $\mathbb{CP}/(z \mapsto \bar{z})$. The dessins are real versions, proposed by S. Orevkov, of Grothendieck's dessins d'enfants. The dessins are graphs embedded in a topological surface and endowed with a certain additional structure. We study the combinatorial properties and decompositions of dessins corresponding to real nodal trigonal curves $C \subset \Sigma$ in real ruled surfaces Σ. Uninodal dessins in any surface with non-empty boundary and nodal dessins in the disk can be decomposed in blocks corresponding to cubic dessins in the disk $\mathbf{D}^2$, which produces a classification of these dessins.

(3) 13h15-14h15 : **Ilia Itenberg**, Lines on quartic surfaces

We study the possible values of the number of straight lines on a smooth surface of degree 4 in the 3-dimensional projective space. We show that the maximal number of real lines in a real non-singular spatial quartic surface is 56 (in the complex case, the maximal number is known to be 64). We also give a complete projective classification of non-singular complex quartics containing more than 52 lines: all such quartics are projectively rigid. Any value not exceeding 52 can appear as the number of lines of an appropriate complex quartic. (Joint work with A. Degtyarev and A. S. Sertöz.)

(4) 14h30-15h30 : **Maria Carrizosa**, Counting polarizations of bounded degree on abelian varieties

We know that there are only finitely many polarizations of given degree (modulo automorphisms) on an abelian variety. We will give a bound for this number.

(5) 16h-17h : **Marco Boggi**, Endomorphisms of Jacobians of algebraic curves with automorphisms

Let C be a very general complex smooth projective algebraic curve endowed with a group of automorphisms G such that the quotient C/G has genus at least 3. I will show that the algebra of $\mathbb{Q}$-endomorphisms of the Jacobian $J(C)$ of C is naturally isomorphic to the group algebra $\mathbb{Q}G$. Time permitting, I will then explain some applications of this result to the theory of virtual linear representations of the mapping class group. This talk is based on joint work with Eduard Looijenga.

Mercredi :

(1) 9h45-10h45 : **Laurent Charles**, From Berezin-Toeplitz operator to entanglement entropy

The first part of my talk will be an introduction to Berezin-Toeplitz quantization on Kähler manifolds. Then I will consider a particular class of Berezin-Toeplitz operators whose symbols are characteristic functions. I will discuss their spectral distribution. As an application, I will explain the area law for the entanglement entropy in Quantum Hall effect.

(2) 11h00-12h00 : **Paul Emile Paradan**, Indices équivariants d'opérateurs de Dirac et limites semi-classiques.

Considérons une variété munie d'une structure spin S équivariante par rapport à l'action d'un groupe de Lie compact G. A chaque fibré en droites équivariant L on associer :

- une famille de représentations $V(k)$ de G qui correspond à la quantification géométrique des données (S, L^k), $k \geq 1$,
- une famille de distributions $\Theta(k)$ sur le dual de l'algèbre de Lie de G qui est un analogue géométrique de la famille $V(k)$.

Dans cet exposé, nous verrons comment exprimer le comportement asymptotique de $\Theta(k)$ au moyen de mesures de Duistermaat-Heckman. Dans le cas où la variété est non-compacte, nous expliquerons comment en déduire des propriétés fonctorielles sur les représentations $V(k)$.

Ce travail est une collaboration avec Michèle Vergne (voir arXiv:1708.08226).

(3) 13h15-14h15 : **Daniel Massart**, Measurable Finsler metrics

we show how Borel-measurable Finsler metrics provide weak solutions to some optimization problems in Riemannian geometry, such as the systolic problem.

(4) 14h30-15h30 : **Alex Cardona**, Spectral Invariants and Global Pseudo-differential Calculus

Global pseudo-differential calculus on compact Lie groups and homogeneous spaces gives, via representation theory, a semi-discrete description of the global analysis and spectral theory of a wide class of operators on these objects. Based on the theory developed by Ruzhansky and Turunen, during this talk we will consider spectral invariants of index type for global homogeneous pseudo-differential operators; some examples and potential applications will be addressed.

(5) 16h-17h : **Clara Aldana**, Compactness of conformal metrics,

A classical question in differential geometry is under which geometrical conditions a sequence of conformal metrics admits a convergent subsequence. After a brief introduction to the topic, I will recall some classical results about compactness of sets of metrics. Then I will report on a joint project with Gilles Carron and Samuel Tapie (Nantes) about compactness of conformal metrics with critical integrability conditions on the scalar curvature.

Jeudi :

(1) 9h45-10h45 : **Alex Berenstein**, Polish groups and automatic continuity.

In this talk I will give an introduction to Polish groups and automatic continuity. We say that a topological group is Polish if it is separable and completely metrizable. We say a Polish group has the automatic continuity property if any algebraic morphism to any separable topological group is continuous.

In joint work with I. Ben Yaacov (ICJ) and J. Melleray (ICJ) we studied these concepts for some groups of isometries and gave a criteria for automatic continuity. I will talk about these criteria and then I will discuss ongoing work with Rafael Zamora (Ph.D. Paris 6) on the group of isometries of some metric structures called randomizations.

(2) 11h00-12h00 : **Pablo Cubides**, Exponentiation is easy to avoid (sometimes)

A celebrated theorem of Chris Miller states that if R is an o-minimal expansion of the field of real numbers then either R is polynomially bounded or the exponential function is definable in R. After introducing an analogue of o-minimality for expansions of algebraically closed valued fields (called C-minimality), the aim of the talk is to show that every C-minimal expansion of a valued field (K, v) having value group $\mathbb{Q}$ is polynomially bounded. In particular, we obtain that any C-minimal expansion of valued fields like $\mathbb{C}_p$, $F^{alg}((t^{\mathbb{Q}}))$ are polynomially bounded. This is a joint work with Françoise Delon.

(3) 13h15-14h15 : **Otmar Venjakob**, Regulator maps for Lubin-Tate extensions

Regulator maps à la Perrin-Riou play an important role in the Iwasawa theory of cyclotomic fields: they map for instance very special (norm compatible systems of) units to p-adic L-functions. Recently the Iwasawa theory for Lubin-Tate extensions has become quite popular and I will report on results towards the construction of regulator maps in this setting using (φ, Γ)-modules (joint work with Peter Schneider).

(4) 14h30-15h30 : **Aurélien Galateau**, The distribution of torsion on subvarieties of abelian varieties.

The Manin- Mumford conjecture describes the distribution of torsion points in subvarieties of abelian varieties. It was proven by Raynaud thirty years ago, and explicit versions were later given by Coleman, Buium or Hrushovski. I will describe a natural way to tackle this problem, by combining algebraic interpolation with classical theorems on homotheties in the Galois representation associated to the torsion of abelian varieties.

(5) 16h-17h : **Guillermo Mantilla**, What arithmetic invariants determine a number field?

One of the most fundamental arithmetical invariants of a number field is its Dedekind zeta function. It is well known that pairs of number fields with the same zeta function, Arithmetically equivalent number fields, share many things such as the discriminant, number of complex and real embeddings, unit group, class number times regulator etc. We are interested in seeing how arithmetic equivalence relates to other arithmetic invariants that we have studied in the past. In addition to this, inspired by an analogy between number fields and rational elliptic curves, we will show some results about zeta functions and trace forms of number fields.

TUESDAY NIGHT 19:30 : Dinner of the conference, La boname de Bruno, 5 Grande Rue des Feuillants, 69001 Lyon.

Vendredi :

(1) 9h45-10h45 : **Maria Paula Gomez**, The Baum-Connes Conjecture and an Oka's principle in Noncommtative Geometry

The Baum-Connes conjecture was introduced by Paul Baum and Alain Connes in the 80's; it gives a way of computing the K-theory of the reduced C*-algebra of a locally compact group. This C*-algebra encodes the topology of the temperate dual of the group and its K-theory is a topological invariant of this space. The conjecture, and some generalizations, are still open for many groups having a strong version of property (T); no real progress have been done for 15 years. Strong property (T) is a rigidity property on groups representations (e.g higher rank Lie groups and there lattices have strong property (T)); it was introduced by Vincent Lafforgue in his work on Baum-Connes as it prevents the methods that have been used to prove the Baum-Connes conjecture to work. Nonetheless, a direction that is still open concerns applying the ideas of Bost, who defined a version of Oka principle in Noncommutative Geometry. In this talk, I will give a short survey on the conjecture and I will explain the statement linking it to Oka's principle.

(2) 11h00-12h00 : **Paul Bressler**, On quasi-classical limits in deformation quantization

Star-products (one parameter formal deformations of the usual product on functions) serve as local models for DQ-algebroids. A DQ-algebroid is a formal one-parameter deformation its "classical limit" which in general is a twisted form of the structure sheaf of the the manifold. As is well known, a star-product on functions on a manifold gives rise to a Poisson on the sheaf of functions. I will explain what sort of additional structure arises on the classical limit of a DQ-algebroid generalizing and extending the Poisson structure.

(3) 13h15-14h15 : **Yves Benoist**, Recurrence on Affine Grassmannians

Let W be a k-dimensional affine subspace in the d-dimensional affine space V, and let S be a symmetric set in the group G of invertible affine transformations of V generating a Zariski dense subgroup of G. We prove with C. Bruere that, if one chooses at random n elements of S and computes their product g, the law of the image of W by g converges when n is going to infinity to a measure m on the affine grassmannian variety. This limit measure m has mass 1 when $2k$ is at least d and is null otherwise.

(4) 14h30-15h30 : **Alberto Medina**, Transformations of flat affine manifold

A flat affine manifold is a manifold endowed with a flat and torsion free linear connection. We will give a new characterization of flat affine manifolds by means of affine representations of the group of the automorphisms of the manifold. From the infinitesimal point of view the representation is given by the connection form and the fundamental form of the bundle of linear frames of the manifold. We will also show the existence of a finite dimensional associative envelope of the Lie algebra of the Lie group group of transformations of the flat affine manifold.

(5) 16h-17h : **Omar Saldarriaga**, Transformation of flat affine Lie groups

We will show the existence of Lie groups endowed with a flat affine bi-invariant connection whose Lie algebra contains the Lie algebra of complete infinitesimal affine transformations of the given Lie group. This is a special case of the characterization given in Medina's talk. We exhibit some results about flat affine manifolds whose group of diffeomorphisms admit a flat affine bi-invariant structure. We finish the presentation exhibiting some examples.