TITLE AND ABSTRACT OF TALKS AT INDO-FRENCH 2016

JAN 11 - JAN 24, 2016

11 Jan 2016

1) **Kumar Murty**

Title : The self power map and splitting of primes .

Abstract In recent years, there has been some interest in understanding the image of the self power map $n \mapsto n^n$ modulo a prime. This map arises in some digital signature schemes. It is difficult to analyze partly because it is not geometric. We will discuss some problems related to this map and its connection to the splitting of primes in certain number fields.

2) **Jean-Pierre Demailly**

Title: Recent progress towards the Green-Griffiths-Lang and Kobayashi conjectures

Abstract The study of entire holomorphic curves contained in projective algebraic varieties is intimately related to fascinating questions of geometry and number theory. The aim of the lectures is to present recent progress on the geometric side of the problem.

The Green-Griffiths-Lang conjecture stipulates that for every projective variety X of general type over $\mathbb{C}$, there exists a proper algebraic subvariety of X containing all non constant entire curves $f : \mathbb{C} \to X$. Using the formalism of directed varieties, we will show that this assertion holds true in case X satisfies a strong general type condition that is related to a certain jet-semistability property of the tangent bundle T_X. It is then possible to exploit this result to investigate the long-standing conjecture of Kobayashi (1970), according to which every general algebraic hypersurface of dimension n and degree at least $2n + 1$ in the complex projective space $\mathbb{P}^{n+1}$ is hyperbolic.

3) **Kausal Verma.**

Title: The boundaries of quadrature domains

Abstract Quadrature domains in the plane are those on which a given test class of holomorphic functions satisfy a generalized mean value property. It is well known that planar quadrature domains have algebraic boundaries (modulo possibly finitely many points). The purpose of this talk will be to outline an alternate way to see this.

4) **Benoit Grbert**

Title: On reducibility of quantum harmonic oscillator on $\mathbb{R}^d$ with quasi periodic in time potential

Abstract We prove that a linear d-dimensional Schrdinger equation on $\mathbb{R}^d$ with harmonic potential x^2 and small t-quasiperiodic potential,

$$i\partial_t u = -\partial_x^2 u + |x|^2 u + \epsilon V(t\omega, x)u, \quad x \in \mathbb{R}^d,$$

reduces to an autonomous system for most values of the frequency vector ω. As a consequence any solution of such a linear PDE remains bounded in all Sobolev norms.

5) **Parimala, R.**

Title: Obstructions to embedding maximal tori in classical groups

Abstract Let k be a number field. We describe an explicit Brauer-Manin obstruction to embedding tori in classical groups. This extends the results of Prasad-Rapinchuk to a more general setting and explains the known counterexamples to the Hasse principle.

(joint work with Eva Bayer-Fluckiger and Tingyu Lee.)

12 Jan 2016

1) **R. Munshi.**

Title: A new form of circle method

Abstract Using the Petersson formula we formulate a device to analytically detect the equation n=m. We compare this with the standard delta method, and give an application in the context of L-functions.

2) **Eknath Ghate**

Title: Reductions of Galois representations of small slopes

Abstract The reduction of the local Galois representation attached to an ordinary (slope 0) form at a prime p away from the level is well known to be reducible. In this talk we shall survey what is known about the reduction when the slope is small but positive.

We concentrate on the case of slope 1, which was treated essentially completely in recent joint work with S. Bhattacharya and S. Rozensztajn. We show that the local reduction is mostly reducible, with its exact shape depends on the congruence class of the weight mod $p-1$. Moreover, we show that in each such class there is a further congruence class of weights mod p where the local reduction is irreducible. We also distinguish between the so called peu and trs ramifie cases in the relevant non-semisimple reducible cases.

The proof uses the compatibility between the p-adic and mod p Local Langlands Correspondences with respect to the process of reduction. This reduces the computation to the automorphic side. We will try and explain most of the key ingredients used in the proof in a self-contained way.

3) **Philip Boalch**

Title: Non-perturbative symplectic geometry

Abstract Just as a Lie group is a multiplicative version of a Lie algebra, there is a class of holomorphic symplectic varieties which are precise multiplicative versions of simpler ("additive") symplectic varieties. In this theory the role of the exponential map is played by the Riemann-Hilbert map, and its extension to the irregular case. I'll describe some examples, and show how a new theory of multiplicative quiver varieties emerges.

4) **Manoj Kummini**

Title: On the cohomology of normalized blow-ups

Abstract Let $(R, \mathfrak{m})$ be a Noetherian three-dimensional Cohen-Macaulay analytically unramified ring, e.g., the local ring at a Cohen-Macaulay point on a three-dimensional variety. Write $X = \operatorname{Proj}\left(\oplus_{n\in\mathbb{N}}\overline{I^n}t^n\right)$, where $\overline{(\cdot)}$ denotes integral closure. (If R is normal, then X is the normalization of the blow-up of $\operatorname{Spec}(R)$ along the (not necessarily reduced) subscheme $\operatorname{Spec}(R/I)$.) We prove some consequences of the vanishing of $\mathrm{H}^2(X, \mathcal{O}_X)$, with regard to conjectures of Itoh (J. Algebra, 1992) and of Lipman (Math. Res. Lett., 1994).

Firstly, X is Cohen-Macaulay. Secondly, if R is equicharacteristic (true in the geometric situation) then $\operatorname{length}_R(\mathrm{H}^1(X, I\mathcal{O}_X^{-1}))-\operatorname{length}_R\left(\frac{\overline{I^2}}{I\overline{I}}\right)$ is zero (if the extended Rees ring $A := \oplus_{n\in\mathbb{Z}}\overline{I^n}t^n$ is Cohen-Macaulay) or at least three (if A is not Cohen-Macaulay). Thirdly, $\mathrm{H}^2_E(X, I^m\mathcal{O}_X) = 0$ for all integers m, where E is the exceptional divisor in X. Finally, if additionally R is regular and X is pseudo-rational, then the adjoint ideals $\widetilde{I^n}, n \geq 1$ satisfy $\widetilde{I^n} = I\widetilde{I^{n-1}}$ for every $n \geq 3$.

5) **Gautam Bharali**

Title: The dynamics of holomorphic correspondences on compact Riemann surfaces

Abstract Owing to the theorem of M. de Franchis, a compact hyperbolic Riemann surface does not admit any interesting iterative holomorphic dynamics. However, these surfaces are rich in holomorphic correspondences. The iteration of such a correspondence gives rise to many questions – which have begun to be investigated fairly recently – that are analogous to those in the theory of iterations of rational maps on the 2-sphere. A part of this talk will be devoted to defining the analogue of the Fatou set for correspondences.

Let F be a holomorphic correspondence on a compact Riemann surface X. Under certain conditions, F admits a canonical measure, μ_F, that is invariant under F in a specific sense and has good ergodic properties. The work of Dinh and Sibony gives several ways of describing μ_F, in view of which the support of μ_F seems to be a good analogue of the Julia set in the case of correspondences. To this end, we show that the support of μ_F is disjoint from the

(analogue of) the Fatou set of F. The proof of this also reveals a dynamically meaningful condition under which the analogues of the Fatou and the Julia set partition the underlying Riemann surface (which is simply definitional in the case of rational maps on the 2-sphere).

1) **V. Lakshmibai.**
Title: Free resolutions of some schubert singularies

Abstract We construct free resolutions of certain closed subvarieties of affine spaces (the socalled opposite big cells of Grassmannians). Our class covers the determinantal varieties, whose resolutions were first constructed by A. Lascoux (Adv. Math., 1978). Our approach uses the geometry of Schubert varieties. An interesting aspect of our work is its connection to the computation of the cohomology of homogeneous bundles (that are not necessarily completely reducible) on partial flag varieties. This work is jointly with M. Kummini, P.Sastry and C.S. Seshadri. We shall also present results for certain subvarieties of opposite big cells of the Lagrangian Grassmannias (work jointly with R. Hodges).

2) **Marc Chaperon**

Title: Invariant manifolds and semi-conjugacy.

Abstract: A simple and efficient approach to invariant manifolds of dynamical systems is presented, based upon generating maps and avoiding any functional analysis. This yields (semi-)conjugacy theorems as well. In the end, a geometric view of KAM theory (in function space!) is suggested, to which the previous approach might apply.

3) **S. Kesavan**

Title: On a degenerate algebraic Riccati equation.

Abstract The existence of solutions to a degenerate algebraic Riccati equation associated to an optimal control problem with infinite time horizon is studied. Under some assumptions on the control system, it is shown that it is possible to select a solution to this equation which provides a feedback control law which will stabilize the system.

4) **Pathasarathy Chakraborty**

Title: An invariant for ergodic actions of compact groups

Abstract An invariant for ergodic actions of compact groups
Abstract: We will introduce a numerical invariant for an ergodic action of a compact (quantum) group on a unital C^* algebra. We will discuss its computation and end with an open question for compact Lie groups. This is joint work with Arup Pal of ISI, Delhi.

5) **Parameswaran, A. J.**

Title: On a Theorem of Deligne and the Slice Theorem

Abstract The aim of this talk is to prove a structure theorem for doubly saturated affine schemes of finite type in GL(V) over algebraically closed fields. This is built on recent results of Deligne and the results of Serre. We obtain Lunas tale slice theorem in positive characteristics as an application. This is a Joint work with V. Balaji.

1)**Raphael Krikorian**

Title: On almost reducibility in quasi-periodic dynamics.

Abstract I will discuss the following question: Is any smooth or analytic orientation preserving diffeomorphism of the circle f with an irrational rotation number α almost reducible in the sense that there exists a sequence of smooth or analytic conjugations g_n such that $g_n^{-1} \circ f \circ g_n$ converges in the smooth topology to $x \mapsto x + \alpha$? I will also discuss the similar question for pseudo-rotations of the disk (orientation and area preserving diffeomorphisms of the 2-disk fixing the origin and the boundary without fixed points).

2) **Riddhi Shah.**

Title: The embedding problem of infinitely divisible probability measures on Lie groups

Abstract We discuss infinitely divisible measure on Lie groups. We discuss the conditions under which an infinitely divisible measure can be embedded in a continuous one-parameter convolution semigroup of probability measures. We survey known results and discuss the latest results obtained (jointly with Dani and Guivarc'h). We also mention some techniques developed by Dani and McCrudden which gives the embeddability in some new cases.

3) **Mathieu Lewin.**

Title: Bose-Einstein condensation: the physical phenomenon and its mathematical proof

Abstract: In 1924, the Indian physicist Satyendranath Bose discovered that, at very low temperature, some quantum particles can suddenly all behave in the same way. After the idea was developped by Albert Einstein, this new state of matter was called a Bose-Einstein condensate. This theoretical prediction was confirmed by experiments many years later in 1995.

In this talk I will present the mathematical formalism of Bose-Einstein condensation, and then review recent works obtained in collaboration with Phan Thanh Nam (Vienna) and Nicolas Rougerie (Grenoble). Of importance is an abstract theorem about the structure of the convex set of bosonic quantum states, which says that infinitely many exchangeable particles have to be somewhat independent.

4)**B V Rajarama Bhat**

Title: Tensor product systems of Hilbert spaces

Abstract One parameter semigroups of *- endomorphisms of the algebra of all bounded operators on a Hilbert space are known as E-semigroups. They are classified up to cocycle conjugacy by tensor product systems of Hilbert spaces. We give a brief account of this theory.

5) **Jeremy Faupin**

Title: On spectral and scattering theories of non-relativistic QED

Abstract In this talk I will present a mathematical model commonly employed to describe an atom interacting with photons, sometimes called the standard model of non-relativistic QED. This model goes back to the early days of Quantum Mechanics and was elaborated in details by Pauli and Fierz in 1938. The energy of the total physical system (atom + photons) is associated with a self-adjoint operator an Hamiltonian acting on a suitable Hilbert space. The Hamiltonian generates the dynamics of the states of the system. To understand phenomena such as relaxation of the atom to its ground state by emission of photons, one is led to analyse the spectrum of the Hamiltonian and study scattering theory. I will review some of the main results of the theory and discuss a few open problems.

15 Jan 2016

1) **T. N. Venkataramana**

Title: Monodromy and Arithmetic Groups

Abstract A quick overview of the Deligne-Mostow theory will be presented. This will lead to questions on arithmeticity of monodromy groups associated to families of cyclic coverings of the projective line. We discuss a result to the effect that the monodromy group is arithmetic if the number of branch points of the cyclic cover is greater than twice the degree of the cover.

2) **Michel Waldschmidt**

Title: Two invariants related to two conjectures due to Nagata.

Abstract: Seshadri's constant is related to a conjecture due to Nagata. Another conjecture, also due to Nagata and solved by Bombieri in 1970, is related with algebraic values of meromorphic functions. The main part of Bombieri's proof leads to a Schwarz Lemma in several variables, the proof of which gives rise to another invariant associated with

symbolic powers of the ideal of functions vanishing on a finite set of points. This invariant is an asymptotic measure of the least degree of a polynomial in several variables with given order of vanishing on a finite set of points. Recent works on the resurgence of ideals of points and the containment problem compare powers and symbolic powers of ideals.

3) **J. Sengupta**

Title: Determination of modular forms from twisted central L Values.

Abstract:This will be a survey style talk on the topic mentioned in the title.

4) **Anne-Marie Aubert**

Title: The Harish-Chandra philosophy of cusp forms adapted to enhanced Langlands parameters

Abstract It is joint work with Ahmed Moussaoui and Maarten Solleveld. Let G be the group of F-rational points of a connected reductive algebraic group over a local non-archimedean field F. Let W_F be the Weil group of F, let $G^\vee$ be the complex dual group of G, and let $\mathrm{Z}(G^\vee)^{W_F}$ denote the fixed points by W_F of the center of $G^\vee$. Let $G^\vee_{\mathrm{sc}}$ and $G^\vee_{\mathrm{ad}}$ be the simply connected cover of the derived group of $G^\vee$, and the adjoint group of $G^\vee$, respectively. We denote by $\mathrm{Z}_{G^\vee}(\varphi)$ the centralizer in $G^\vee$ of $\varphi(W_F \times \mathrm{SL}_2(\mathbb{C}))$, and by $\mathrm{Z}^1_{G^\vee_{\mathrm{sc}}}(\varphi)$ the inverse image of $\mathrm{Z}_{G^\vee}(\varphi)/\mathrm{Z}(G^\vee)^{W_F}$ under the isogeny $G^\vee_{\mathrm{sc}} \to G^\vee_{\mathrm{ad}}$. If G is an inner form of a split group, then we have $\mathrm{Z}^1_{G^\vee_{\mathrm{sc}}}(\varphi) = \mathrm{Z}_{G^\vee_{\mathrm{sc}}}(\varphi)$.

Enhanced Langlands parameters for G are pairs (φ, ρ) formed by a relevant Langlands parameter $\varphi\colon W_F \times \mathrm{SL}_2(\mathbb{C}) \to G^\vee \rtimes W_F$ enhanced by an irreducible complex representation ρ of the group of components of $\mathrm{Z}^1_{G^\vee_{\mathrm{sc}}}(\varphi)$.

We will introduce a notion of cuspidality for enhanced L-parameters for G, which conjecturally puts the supercuspidal irreducible representations of G in bijection with such enhanced L-parameters. We will also define a cuspidal support map for enhanced L-parameters, and a decomposition of the set of them into Galois analogues of the Bernstein components of the set $\mathrm{Irr}(G)$ of irreducible smooth representations of G.

It will reveal a new structure in the space of enhanced L-parameters for G, that of a disjoint union of twisted extended quotients. This is an analogue of the ABPS conjecture (about $\mathrm{Irr}(G)$) on the Galois side of the local Langlands correspondence. Only, on the Galois side it is no longer conjectural. These results will be useful to reduce the problem of finding a local Langlands correspondence for G-representations to the corresponding problem for supercuspidal representations of Levi subgroups of G.

The main machinery behind this comes from perverse sheaves on algebraic groups. The extension of Lusztig's generalized Springer correspondence to disconnected complex reductive groups H provides a bijection between, on the one hand, pairs consisting of a unipotent element u in H and an irreducible representation of the component group of the centralizer of u in H, and, on the other hand, irreducible representations of a set of twisted group algebras of certain finite groups. Each of these twisted group algebras contains the group algebra of a Weyl group, which comes from the neutral component of H. The link with a given Langlands parameter φ is obtained by taking for H the centralizer in $G^\vee_{\mathrm{sc}}$ of $\varphi(W_F)$, and for u the image by φ of $(1, \left(\begin{smallmatrix} 1 & 1 \\ 0 & 1 \end{smallmatrix}\right))$.

5) **Shiva Shankar**

Title: The Central Definition of Control Theory

Abstract I shall explain the notion of a 'controllable (dynamical) system' due to R.E.Kalman, and its post-modern generalisation due to J.C.Willems.

1) **Pierre Colmez**

Title: The p-adic Langlands program

Abstract Following Wiles's proof of Fermat's last theorem, a p-adic version of the Langlands program has emerged. I will give an introduction to this circle of ideas with an emphasis on the group GL_2.

2) **Xavier Viennot.**

Title: At the crossroad of algebra, combinatorics and physics: the 2-species PASEP

Abstract The PASEP (partially asymmetric exclusion model) is a model of particles hopping on a one-dimensional strip of N sites with open boundaries. It has been intensively studied by physicists and appears as a toy model in the physics of dynamical systems. The distribution of stationary probabilities has been computed using the so-called matrix ansatz (Derrida, Evans, Hakim, Pasquier). The solution involves a certain quadratic algebra and a representation of this algebra with infinite tridiagonal matrices related to the Askey-Wilson polynomials. These polynomials are a famous famous family of orthogonal polynomials which sit at the top of the hierarchy of classical orthogonal polynomials.

In recent years intensive works has been done by combinatorists in order to give combinatorial interpretations of these stationary probabilities in terms of some weighted tableaux: permutations tableaux (Postnikkov, Steingrimsson, Williams, Corteel), alternative tableaux (X.V.), tree-like tableaux (Aval, Boussicault, Nadeau), straircase tableaux (Corteel, Williams). The combinatorics of permutations, Catalan numbers and orthogonal polynomials plays a crucial role.

The PASEP model has been extended in physics with two types of particles. In this talk we introduce rhombic alternative tableaux which give combinatorial interpretation of the stationary probabilities. These tableaux defined from a tiling of some portions of the triangular lattice, are enumerated by the Lah numbers which are counting certain assembles of permutations. Their weighted generating function give a combinatorial interpretation of the 2-species PASEP (with 3 parameters). We describe a bijection between rhombic alternative tableaux and assembles of permutations and get a bijective proof of the formula giving the partition function of the model. The general 2-species model with 5 parameters is related to Koorwinder-Macdonald polynomials (Corteel, Mandelshtam, Williams). (This is a joint work with Olya Mandelshtam, Berkeley).

3) **Arnaldo Nogueira.**

Title: Piecewise contractions and its applications

Abstract Our talk is concerned with the study of the dynamical systems which are defined piece- wise contraction maps (PC maps). Certain mathematical models, like contracting outer billiards and switched flow systems, are described by PC maps. In the setup of the models usually the PC maps are defined on a convex set and it is expected that most orbits of a typical map be eventually periodic. Our aim is to present results about the asymptotical behavior of a typical map. Our approach is the following: We fix an Iterated Function System $\{\varphi_1, \ldots, \varphi_n\}$ where the maps are Lipschitz contractions defined in a (convex) set D. Every partition of the set D into n convex subsets, $\{P_1, \ldots, P_n\}$, defines a piecewise contraction map $f : DD$, in the natural way: $f(x) = \varphi_i(x)$ for every $x \in P_i$. We will show that in the one-dimensional case a typical PC map, in the metrical sense of the parameter set, is asymptotically periodic and has at most n periodic orbits. A result for the multi-dimensional case will also be discussed. Joint work with Benito Pires and Rafael Rosales.

1) **J.-L. Colliot-Thélène**

Title: Integral points and Brauer-Manin obstruction : a survey

Abstract One extension of the Chinese remainder theorem is strong approximation for simply connected algebraic groups. For groups and more generally varieties which are not geometrically simply connected, strong approximation fails. The talk will describe classes of varieties for which this failure may be accounted for by the integral version of the Brauer-Manin obstruction, a classical tool for the study of rational points.

2) **V. S. Sunder**

Title: From graphs to free products

Abstract We investigate a construction which associates a finite von Neumann algebra $M(\Gamma, \mu)$ to a finite weighted graph (Γ, μ). The simplest examples - and in fact, the 'building blocks' for the most general case - yield natural Fock-type models of operators with Wigner's semi-circular distribution, circular operators and operators with free Poisson distributions. Pleasantly, but not surprisingly, the von Neumann algebra associated to to a 'flower with n petals' is the von Neumann algebra $L\mathbb{F}_n := \lambda(\mathbb{F}_n)''$ (generated by the left-regular representation) of the free group on n generators.

In general, the algebra $M(\Gamma, \mu)$ is a free product, with amalgamation over a finite-dimensional abelian subalgebra corresponding to the vertex set, over algebras associated to subgraphs 'with one edge' (actually a pair of dual edges).

3) **Sujatha, R**

Title: Derived birational invariants and unramified cohomology.

Abstract: We introduce some new birational invariants arising from unramified cohomology studied in the context of Voevodsky's theory in a derived category setting. This is joint work with Bruno Kahn.

4) **Sukumar Adhikari**

Title: A classical Ramsey-type result of Schur.

Abstract: The classical Ramsey-type result of Schur completes its hundred years of existence this year. It has seen generalizations in several ways. We shall discuss some of these generalizations, related open questions and some recent results.

5) **Wieslawa Niziol**

Title : Syntomic complexes and p-adic nearby cycles.

Abstract For a semistable scheme over a mixed characteristic local ring I will present a proof of a comparison isomorphism, up to some universal constants, between truncated sheaves of p-adic nearby cycles and syntomic cohomology sheaves. This generalizes the comparison results of Kato, Kurihara, and Tsuji for small Tate twists (where no constants are necessary) as well as the comparison result of Tsuji that holds over the algebraic closure of the field. I will also explain how to combine this local comparison isomorphism with the theory of finite dimensional Banach Spaces and finitness of étale cohomology of rigid analytic spaces proved by Scholze to prove a Semistable conjecture for formal schemes with semistable reduction. This is a joint work with Pierre Colmez.

1) **C.S. Rajan**

Title: A Torelli type theorem involving base changes for elliptic surfaces

Abstract Given two elliptic surfaces over a base curve C, we show that any compatible family of effective isometries of the Néron-Severi lattices of the base changed elliptic surfaces for all finite maps $B \to C$ arises from an isomorphism of the elliptic surfaces upto a finite base change. Without the effectivity hypothesis, we can conclude that the two elliptic fibrations are isomorphic (joint work with S. Subramanian).

2) **Michel Brion**

Title: Commutative algebraic groups up to isogeny.

Abstract The commutative algebraic groups over a field k form an abelian category C, which has been studied by Serre and Oort when k is algebraically closed. In particular, they showed that the homological dimension of C is 1 in characteristic 0, and 2 in positive characteristics. In the talk, we will discuss the category of commutative algebraic groups up to isogeny, which turns out to be much simpler. In particular, its homological dimension is 1 over an arbitrary field.

3) **Amalendu Krishna**
Title: Zero cycles on affine varieties.

Abstract The aim of this talk is to study the Affine Roitman torsion problem for 0-cycles on singular varieties. We show that the affine Roitman torsion problem has positive solution for all affine varieties over an algebraically closed field. We shall describe some applications of this solution. In particular, we shall show that an old open question of Murthy has a positive solution.

4) **Colin Vincent**

Title: Towards higher-dimensional Heegaard-Floer homology.

Abstract: We associate to a Weinstein domain and to a symplectomorphism fixing pointwise its boundary a Heegaard-Floer type homology. I will discuss invariance properties and relations with the contact homology of the contact structure supported by the corresponding open book. This is joint work with Ko Honda.

5) **M Krishna**

Title: Eigenvalue statistcs for random operators

Abstract: We present the results on eigenvalue statistics for random Schrodinger operators and the Anderson model done by the group at IMSc.

20 Jan 2016

1) **Bruno Khan.**

Title: Motives with modulus

Abstract I will report on joint work with Shuji Saito and Takao Yamazaki, in which we construct and study a triangulated category of motives with modulus that extends Voevodsky's category in such a way as to encompass non-homotopy invariant phenomena.

2) **V.R. S. Varadhan**

Title: Large Deviations for Brownian local times. A second look.

Abstract Since Brownian motion is not positive recurrent, the large deviation behavior of its local time, or occupation measure is not coercive, unless the space of probability measures on R^d is compactified. For many problems this needs to be done in a translation invariant manner. This is an attempt to do that.

3) **B. Ramakrishnan**

Title: Theory of newforms of half-integral weight.

Abstract:In this lecture, we present a survey of our collaborative works on the theory of newforms of half-integral weight and the extension of the Kohnen plus space to even levels. We also report on the extension of the theory of newforms for the Eisenstein series space obtained by our collaborator.

1) **Mahan, MJ**

Title: Limits of limit sets

Abstract Let G_n be a sequence of Kleinian groups converging to G. We deal with the dependence of the convergence of the corresponding Cannon-Thurston (CT) maps on the nature of convergence of the Kleinian groups. More precisely, we shall deal with the following two questions:
1) If G_n converges to G strongly, do the corresponding CT maps converge uniformly?
2) If G_n converges to G algebraically, do the corresponding CT maps converge pointwise?
This is joint work with Caroline Series.

2) **Oilvier Ramaré**

Title: The Brun-Titchmarsh inequality

Abstract A given interval length N being fixed, the maximal number of primes $\rho(N)$ that are in an interval of this length may contain is a major quantity already investigated by Hardy and Littlewood in 1922. The Brun-Titchmarsh inequality in the form given by Montgomery and Vaughan in 1973 provides the upper bound $2N/\log(N)$ for $\rho(N)$; a first unsolved question is to decide whether this factor 2 is tight or not. A similar bound holds for primes in arithmetic progressions and breaking the factor 2 is known to be equivalent to showing that no Siegel zero exists, or equivalently that enough small primes split in some quadratic extensions.

This talk will present a history of the problem and conclude with a new result. By using a functional inequality that mixes the Selberg sieve and the Large sieve, we prove, together with Soroosh Yazdani, that $\rho(N) \leq 2N/(\log(xN + 5.66 + o(1))$. The method gives ground to the conjecture that the constant 5.66 can be replaced by an arbitrary large constant.

3) **Uma, V.**

Title: Equivariant K-theory of regular compactifications: further de- velopments.

Abstract: In this talk we shall describe the $\tilde{G} \times \tilde{G}$-equivariant K-ring of X, where $\tilde{G}$ is a factorial cover of a connected complex reductive algebraic group G, and X is a regular compactification of G. Further- more, using the description of $K_{\tilde{G}\times\tilde{G}}(X)$, we describe the ordinary K- ring $K(X)$ as a free module of rank the cardinality of the Weyl group, over the $K-$ring of a toric bundle over G/B, with fibre the toric variety $\overline{T}^+$, associated to a smooth subdivision of the positive Weyl chamber. This generalizes our previous work on the wonderful compactification. Further, we give an explicit presentation of $K_{\tilde{G}\times\tilde{G}}(X)$ as well as $K(X)$ as an algebra over the $K_{\tilde{G}\times\tilde{G}}(\overline{G}_{ad})$ and $K(\overline{G}_{ad})$ respectively, where $\overline{G}_{ad}$ is the wonderful compactification of the adjoint semisimple group G_{ad}. Moreover, in the case when X is a regular compactification of G_{ad}, we give a geometric interpretation of the above presentations in terms of the equivariant and ordinary Grothendieck ring of a canonical toric bundle over $\overline{G}_{ad}$).

4) **Laurent Manivel**

Title: Hyperkahler varieties as parameter spaces

Abstract Hyperkahler varieties are an important class of complex varieties, with a rich and beautiful general theory but only few examples, in particular compact ones. I will discuss the possibility to construct hyperkahler varieties as parameter spaces for cycles on varieties with special Hodge structures. In particular I will explain such a construction in connection with the exceptional complex Lie groups (joint work with Atanas Iliev).

5) **C. R. E. Raja**

Title: Groups with expansive automorphisms

Abstract Structure of totally disconnected locally compact groups that admit expansive automorphisms would be presented. This is a joint work with H. Glockner of Universitat Paderborn.

18) **Gilles Pisier**

Title: On the non-commutative Khintchine inequalities

Abstract This is joint work with Éric Ricard. We give a proof of the Khintchine inequalities in non-commutative L_p-spaces for all $0 < p < 1$. This case remained open since the first proof given by Françoise Lust-Piquard in 1986 for $1 < p < \infty$. These inequalities are valid for the Rademacher functions or Gaussian random variables, but also for more general sequences, e.g. for lacunary Fourier series or the analogues of Gaussian variables in free probability. In the most classical setting, the non-commutative Khintchine inequalities deal with Rademacher series of the form

$$S = \sum\nolimits_k r_k(t) x_k$$

where (r_k) are the Rademacher functions on the Lebesgue interval where the coefficients x_k are in the Schatten q-class or in a non-commutative L_q-space associated to a semifinite trace τ. Let us denote simply by $\|.\|_q$ the norm (or quasi-norm) in the latter Banach (or quasi-Banach) space, that we will denote by $L_q(\tau)$. When τ is the usual trace on $B(\ell_2)$, we recover the Schatten q-class. By the non-commutative Khintchine inequalities, we mean the following: For any $0 < q < \infty$ there are positive constants α_q, β_q such that for any finite set $(x_1, \dots, x_n)$ in $L_q(\tau)$ we have

$$(\beta_q)^{-1} |||(x_k)|||_q \le \left(\int \|S(t)\|_q^q dt \right)^{1/q} \le \alpha_q |||(x_k)|||_q$$

where $|||(x_k)|||_q$ is defined as follows:
If $2 \le q < \infty$

$$|||(x_k)|||_q \stackrel{\text{def}}{=} \max \left\{ \left\| \left(\sum x_k^* x_k \right)^{\frac{1}{2}} \right\|_q , \left\| \left(\sum x_k x_k^* \right)^{\frac{1}{2}} \right\|_q \right\} \tag{0.1}$$

and if $0 < q \le 2$:

$$|||x|||_q \stackrel{\text{def}}{=} \inf_{x_k = a_k + b_k} \left\{ \left\| \left(\sum a_k^* a_k \right)^{\frac{1}{2}} \right\|_q + \left\| \left(\sum b_k b_k^* \right)^{\frac{1}{2}} \right\|_q \right\}. \tag{0.2}$$

Note that $\beta_q = 1$ if $q \ge 2$, while $\alpha_q = 1$ if $q \le 2$ and the corresponding one sided bounds are easy. The difficulty is to verify the other side. We do this by "extrapolating" the case $1 \le q < 2$.

2) **Arul Shankar**

Title: Polynomials with squarefree discriminant

Abstract A basic question of analytic number theory is that of understanding the density of squarefree values taken by an integer polynomial. We will study this question for a special class of integer polynomials, namely, discriminants of polynomials in one variable. This is joint work with Manjul Bhargava and Xiaoheng Wang.

3) **Emmanuel Giroux.**

Title: Existence of Lefschetz fibrations on Stein and Weinstein domains

Abstract In this talk, I will present our joint work with John Pardon showing that every Stein or Weinstein domain may be realized (up to deformation) as a Lefschetz fibration over the disk. The proof is an application of Donaldson's quantitative transversality techniques.

4) **Ravi Raghunathan**

Title: Integral representations of L-functions and Hecke operators.

Abstract We investigate the holomorphy of automorphic L-functions by exploiting relations between period functions given by Hecke operators.

5) **K.M.Tamizhmani**

Title: Singularities, Algebraic entropy and Integrability of discrete Systems

Abstract:In this talk, we discuss about two integrability detectors, namely, singularity confinement approach and algebraic entropy method. for discrete systems. The power of these methods are demonstrated by deriving discrete Painleve equations and linearizable systems.

23 Jan 2016

1) **S.G. Dani**

Title: Surjectivity of the exponential map

Abstract The question of "exponentiality" (viz. surjectivity of the exponential map) has attracted considerable attention in literature. One of the pending issues is to relate the exponentiality of a Lie group with the exponentiality of its radical. In this talk I shall discuss the general question of exponentiality and describe certain conditions under which such an implication holds.

2) **Sinnou David**

Title: On Lehmer Problem

Abstract We shall discuss the various aspects of Lehmer's problem from the classical statement by Lehmer to the more recent group variety set up.

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Laurent Lafforgue

Title : Syntactic categories for Nori motives.

Abstract : The purpose of the talk will be to report about a preprint (http://arxiv.org/abs/1506.06113) signed with Luca Barbieri-Viale and Olivia Caramello. All the results are due to Olivia Caramello, starting from a question raised by Luca Barbieri-Viale after I had talked to him about the theory of "classifying toposes" which I had learnt from her. This preprint gives a completely new interpretation and generalisation of Madhav Nori's construction in the theory of motives. Let's recall Nori's construction had associated a universal Q-linear abelian category of "motives" to any homological or cohomological functor with values in finite dimensional Q-linear vector spaces. Nori himself had applied his general categorical construction to the Betti homology functor to define an actual category of motives for schemes over a field of characteristic 0. Caramello's construction shows Nori's category is equivalent to the so-called "syntactic category" of a first-order "regular" theory (in the sense of logic) associated to such a homological or cohomological functor. It does'nt need anymore the finite-dimensions hypothesis so that it associates a universal Q-linear abelian category of motives to any homological or cohomological functor with coefficients in a field of characteristic 0, such as l-adic or p-adic cohomology. In particular, it works for schemes over an arbitrary field of arbitrary characteristic. Furthermore, the universal Q-linear abelian categories associated to different cohomological functors are proved to be equivalent if and only if the different first-order "regular" theories associated to these functors are the same. As a consequence, the existence of a category of motives in the classical sense is equivalent to the propery that the classical cohomological functors all define the same "regular" theory. In other words, if motives actually exist, they can be considered as objects in logic.