



AL03

Number Theory

Teoría de Números

Organizers

Organizadores

Antolatzaileak

Beatriz Barbero Lucas

(University College Dublin)

Daniel Gil Muñoz

(Charles University in Prague)

Álvaro González Hernández

(University of Warwick)

Javier Guillán Rial

(Universidad de Barcelona)

Description

Descripción

Deskribapena

In this parallel session, various topics related to number theory and other related areas will be explored. Attendees will enjoy short talks on abelian varieties, diophantine equations and modularity, elliptic curves and Galois representations, zeta functions, geometry in positive characteristic, and applications to coding theory, among others. The session will also encourage the exchange of ideas and collaboration, allowing mathematicians to discuss open problems in an informal setting.

En esta sesión paralela se explorarán varios temas relacionados con la teoría de números y otras áreas afines. Los asistentes podrán disfrutar de charlas cortas sobre variedades abelianas, ecuaciones diofánticas y modularidad, curvas elípticas y representaciones de Galois, funciones zeta, geometría en característica positiva y aplicaciones a la teoría de códigos entre otros. También se fomentará el intercambio de ideas y la colaboración, permitiendo a los participantes discutir problemas abiertos en un ambiente informal.

MSC Codes	Códigos MSC	MSC Kodeak
	11-02 (primary)	
	14G17; 11D61; 11G18; 11G10; 11G05; 14J28; 11G30; 11G50; 11T71; 11F80; 11M41 (secondary)	

Slots	Bloques	Blokeak
	1.C (Aula 0.3); 2.A (Aula 0.3); 2.B (Aula 0.3)	

QR Code	Código QR	QR Kodea
		

Session Schedule	Horario de la Sesión	Saioaren Ordutegia
M14 17:30-17:50 0.3 <i>Generalised Jacobians of modular curves and their rational torsion.</i> Mar Curcó Iranzo (Utrecht University)		
M14 18:00-18:20 0.3 <i>How to obtain new quantum codes from Generalized Monomial-Cartesian Codes</i> Beatriz Barbero Lucas (University College Dublin)		
M14 18:30-18:50 0.3 <i>"Safe chains" and their applications in Langlands' functoriality</i> Javier Guillán Rial (Centre de Recerca Matemàtica)		
M14 19:00-19:20 0.3 <i>Perfect codes over non-prime power alphabets: an approach based on Diophantine equations</i> Pedro José Cazorla García (Universidad Pontificia Comillas)		

L16 | 11:00-11:20 | 0.3

Comparing Galois representations

Ignasi Sánchez Rodríguez (Universitat de Barcelona)

L16 | 11:30-11:50 | 0.3

The form of a quadratic form

Álvaro Serrano Holgado (Universidad de Salamanca)

L16 | 12:00-12:20 | 0.3

Galois module theory for degree p extensions of p -adic fields

Daniel Gil Muñoz (Charles University & Università di Pisa)

L16 | 12:30-12:50 | 0.3

Monodromy and equidistribution

Francisco García-Cortés (Universidad de Sevilla)

L16 | 16:30-16:50 | 0.3

Intersections of the automorphism and p -rank strata in the moduli space of genus two curves

Alvaro Gonzalez Hernandez (University of Warwick)

L16 | 17:00-17:20 | 0.3

Serre-Tate theory

Ines Borchers Arias (Princeton University)

L16 | 17:30-17:50 | 0.3

Abelian varieties that split modulo all but finitely many primes

Enric Florit (Universitat de Barcelona)

L16 | 18:00-18:20 | 0.3

(r, δ) -LRCs from evaluation codes

Helena Martín-Cruz (Universitat Jaume I)

Tuesday 14
17:30-17:50
[Room 0.3]

Martes 14
17:30-17:50
[Aula 0.3]

Asteartea 14
17:30-17:50
[Gela 0.3]

Generalised Jacobians of modular curves and their rational torsion.

Mar Curc3 Iranzo

(Utrecht University)

Consider the generalised Jacobian $J_0(N)_m$ of the modular curve $X_0(N)$ with respect to a modulus m . This algebraic group also seems to be related to the arithmetic of $X_0(N)$ through the theory of modular forms. In the talk we will present new results that compute the \mathbb{Q} -rational torsion of $J_0(N)$ for N an odd integer with respect to a cuspidal modulus m . These generalise previous results of Yamazaki, Yang and Wei. We will also discuss how our results relate to generalised Ogg's conjecture.

[arXiv:2112.03741](https://arxiv.org/abs/2112.03741)

Tuesday 14
18:00-18:20
[Room 0.3]

Martes 14
18:00-18:20
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18:00-18:20
[Gela 0.3]

How to obtain new quantum codes from Generalized Monomial-Cartesian Codes

Beatriz Barbero Lucas

(University College Dublin)

Quantum computers are a great tool to attack some intractable problems for classical computers, such as the prime factorization problem. However, quantum computer implementations have higher error rates than classical computers, making reliability a challenge. That is where Quantum Error correction codes come into play. In this talk I will give an overview of how to construct a certain kind of Generalized Monomial-Cartesian codes that allow us to obtain new quantum codes.

Joint work with Fernando Hernando, Helena Mart3n-Cruz, Gary McGuire.

[arXiv:2307.15488](https://arxiv.org/abs/2307.15488)

Tuesday 14

18:30-18:50

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Asteartea 14

18:30-18:50

[Gela 0.3]

*"Safe chains" and their applications in Langlands' functoriality***Javier Guillán Rial**

(Centre de Recerca Matemàtica)

In this talk we are going to introduce the concept of "safe chains" as a way to make use of congruence graphs of modular forms to prove some instances of Langlands' functoriality. In order to illustrate this method we are going to explain some examples of its applicability such as the proof of Serre's conjecture or base change, both over \mathbb{Q} .

Tuesday 14

19:00-19:20

[Room 0.3]

Martes 14

19:00-19:20

[Aula 0.3]

Asteartea 14

19:00-19:20

[Gela 0.3]

*Perfect codes over non-prime power alphabets: an approach based on Diophantine equations***Pedro José Cazorla García**

(Universidad Pontificia Comillas)

Perfect codes have been classical objects of study in both Pure and Applied Mathematics, but their existence has only been completely settled for alphabets of prime power size. In this talk, we will explore how the existence of certain perfect error correcting codes entails the existence of solutions to a class of Diophantine equations. In addition, we shall present techniques that allow to solve them, such as the resolution of S-unit equations and the determination of Heegner points.

[arXiv:2405.03347](https://arxiv.org/abs/2405.03347)

Thursday 16**11:00-11:20****[Room 0.3]****Jueves 16****11:00-11:20****[Aula 0.3]****Osteguna 16****11:00-11:20****[Gela 0.3]*****Comparing Galois representations*****Ignasi Sánchez Rodríguez**

(Universitat de Barcelona)

How does one prove that a particular abelian variety corresponds to a specific modular form? How can we show that two abelian varieties belong to the same isogeny class? In this talk, we will introduce the well-established "Faltings-Serre approach,"^a a powerful method for comparing Galois representations. We will explore why this approach works, why it is effective and highlight recent developments and current research.

Joint work with Nuno Freitas.

Thursday 16**11:30-11:50****[Room 0.3]****Jueves 16****11:30-11:50****[Aula 0.3]****Osteguna 16****11:30-11:50****[Gela 0.3]*****The form of a quadratic form*****Álvaro Serrano Holgado**

(Universidad de Salamanca)

The theory of binary quadratic forms, as developed by Fermat, Legendre, Gauss and others, is one of the cornerstones of Elementary Number Theory, due to its connections to number fields, the class number, and so on. We will see a more visual approach to quadratic forms, by means of what Conway called the "graph" of a quadratic form. This gives us simple new ways of proving some of the most important results of the theory, such as the classification problem or the finiteness of the class numbers.

Thursday 16

12:00-12:20

[Room 0.3]

Jueves 16

12:00-12:20

[Aula 0.3]

Osteguna 16

12:00-12:20

[Gela 0.3]

Galois module theory for degree p extensions of p -adic fields**Daniel Gil Muñoz**

(Charles University & Università di Pisa)

Galois module theory aims to describe the structure of the ring of integers of Galois extensions of local and global fields as module over a suitable ring depending on the Galois group of the extension. Whether such a module is free or not is a problem of long-standing interest. In this talk we shall study these questions for ramified degree p extensions of p -adic fields, where p is an odd prime. If time permits, we will explore non-Galois generalizations of this problem to Hopf-Galois theory.

Thursday 16

12:30-12:50

[Room 0.3]

Jueves 16

12:30-12:50

[Aula 0.3]

Osteguna 16

12:30-12:50

[Gela 0.3]

Monodromy and equidistribution**Francisco García-Cortés**

(Universidad de Sevilla)

We review the phenomenon of equidistribution for Frobenius traces of local systems over varieties defined over finite fields and the role played by the monodromy group. In doing so we look at actual computational data obtained in concrete examples and we present cases in which the distribution is discrete, i.e. the underlying monodromy group is finite. We finish by reporting new local systems with finite monodromy group that were obtained in joint work with Antonio Rojas-León.

Original results were obtained jointly with Antonio Rojas-León.

[arXiv:2406.10385](https://arxiv.org/abs/2406.10385)

Thursday 16

16:30-16:50

[Room 0.3]

Jueves 16

16:30-16:50

[Aula 0.3]

Osteguna 16

16:30-16:50

[Gela 0.3]

Intersections of the automorphism and p -rank strata in the moduli space of genus two curves

Alvaro Gonzalez Hernandez

(University of Warwick)

There are two key invariants of a curve over $\overline{\mathbb{F}_p}$: its automorphism group and its p -rank. Therefore, it is natural to ask ourselves, if we pick G and f , is there a curve with automorphism group G and p -rank f ?

In this talk, I will answer this question for genus two curves by studying the intersection of the loci of curves with prescribed p -rank and with prescribed automorphism group, inside of the coarse moduli space of genus two curves.

Thursday 16

17:00-17:20

[Room 0.3]

Jueves 16

17:00-17:20

[Aula 0.3]

Osteguna 16

17:00-17:20

[Gela 0.3]

Serre-Tate theory

Ines Borchers Arias

(Princeton University)

Serre-Tate theory proves that studying deformation theory of abelian varieties in positive characteristic is a semi-linear algebraic problem, and gives a description of the deformation space of such abelian varieties. I will introduce the objects required to rigorously state these theorems and sketch their proofs.

Thursday 16

17:30-17:50

[Room 0.3]

Jueves 16

17:30-17:50

[Aula 0.3]

Osteguna 16

17:30-17:50

[Gela 0.3]

*Abelian varieties that split modulo all but finitely many primes***Enric Florit**

(Universitat de Barcelona)

It is well-known that abelian surfaces with QM split modulo almost all primes. This has earned them the name of fake elliptic curves, and they cannot be differentiated from the square of an elliptic curve by looking at a single local factor.

In this talk we will show that this is a more general phenomenon: when $\text{End}(A)$ is non-commutative, A splits modulo all but finitely many primes p of k . This will involve a study division algebras, after which the result follows by applying Honda-Tate theory.

[arXiv:2404.08496](https://arxiv.org/abs/2404.08496)

Thursday 16

18:00-18:20

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Jueves 16

18:00-18:20

[Aula 0.3]

Osteguna 16

18:00-18:20

[Gela 0.3]

 *(r, δ) -LRCs from evaluation codes***Helena Martín-Cruz**

(Universitat Jaume I)

Locally recoverable codes arose to treat the repair problem for large scale distributed and cloud storage systems. An (r, δ) -LRC, C , is an error-correcting code such that any position in C can be recovered from at most r positions but tolerating other $\delta - 1$ erasures. In this talk we give several families of optimal (r, δ) -LRCs which are certain evaluation codes obtained when evaluating multivariate polynomials in a prefixed set of points.

These results were obtained jointly with C. Galindo and F. Hernando.

[doi:10.1007/s10623-024-01403-z](https://doi.org/10.1007/s10623-024-01403-z)