

# Algebraic Days of Gabon 5th Edition

ÉCOLE NORMALE SUPÉRIEURE

LIBREVILLE, GABON

MARCH 10-23, 2025

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## Coordinators

Cécile Armana, University Marie and Louis Pasteur, France

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[website of the event](#)

[website of the programme \*Arithmetic and Geometry in central Africa\*](#)

*The Algebraic Days of Gabon, 5th Edition* will take place in École Normale Supérieure (ENS) in Libreville, Gabon, from March 10 to 23, 2025. It will consist of three main activities:

- **Advanced Courses for PhD and Master students.** The program will consist of three courses:
  - *Introduction to p-adic Galois representations* by Ahmed Abbes, CNRS and IHES, France [second week].  
On the first week there will be *advanced preparatory lectures* for this course.
  - *Lattices and codes: arithmetic for communication systems* by Frédérique Oggier, Birmingham University, UK [first week]. This course is supported by CIMPA as a [CIMPA Course](#).
  - *Introduction to PARI/GP* by Marine Rougnant, University Marie et Louis Pasteur, Besançon, France [first week].
- **Research lectures and Progress reports.** Lectures given by Researchers, and by master and PhD students. This is also a review of recent [REDAGAAC](#) activities. There will be also contributed external talks.
- **A series of events to promote mathematics (on March 15).**
  - Outreach activities about the gender gap in science in the framework of the International Women’s Day 2025, jointly organized with the *Association des femmes mathématiciennes du Gabon* which is the local branch of the [African Women in Mathematics Association](#),
  - Activities for popularizing mathematics in the framework in the International Day of Mathematics, but also the Mathematics Olympiad of the ENS Libreville.

This event has received a special support from [International Center for Mathematical Sciences \(ICMS\)](#), Edinburgh, UK.

	9:15-9:45	10-11	11-12	2:00-3:00	3:15-4:15	4:30-5:30
March 10	opening					
March 11						
March 12						
March 13						
March 14					Pi Day	Pi Day
March 15		Women Day'25	Women Day'25			
March 17	discussion					
March 18	discussion					
March 19	discussion					
March 20	discussion					
March 21	discussion			olymp. awards		

# Advanced Courses

These courses are intended for master and PhD students, and future teachers in mathematics, as part of their initial training and to help them gain sufficient perspective into the field they will be teaching.

This school is partially supported by <https://www.cimpa.info/> in the form of CIMPA course.

The program consists of three courses:

- *Introduction to  $p$ -adic Galois representations* by Ahmed Abbes, CNRS and IHES, France.  
There will be *Advanced preparatory lectures* for this course.
- *Lattices and codes : arithmetic for communication systems* by Frédérique Oggier, Birmingham University, UK.
- *Introduction to PARI/GP* by Marine Rougnant, University Marie et Louis Pasteur, Besançon, France

## Abstracts

AHMED ABBES

Introduction to  $p$ -adic Galois representations

*I will present some of the fundamental results of Tate and Sen on  $p$ -adic Galois representations of  $p$ -adic local fields. Let  $K$  be a complete discrete valuation field of characteristic 0, with perfect residue field of characteristic  $p > 0$ ,  $\bar{K}$  an algebraic closure of  $K$ ,  $C$  the  $p$ -adic completion of  $\bar{K}$ , and  $G_K = \text{Gal}(\bar{K}/K)$  the Galois group of  $\bar{K}$  over  $K$ . I will first present the results of Tate and Sen on the continuous cohomology of  $C$ . I will then explain Sen's theory for continuous  $C$ -representations of  $G_K$ , that is, continuous semi-linear representations of  $G_K$  on finite dimensional  $C$ -vector spaces. Let  $K_\infty$  be the cyclotomic  $\mathbb{Z}_p$ -extension of  $K$  contained in  $\bar{K}$ . The ultimate goal of this theory is to associate to such a  $C$ -representation  $W$ , a finite dimensional  $K_\infty$ -vector space  $V$  equipped with a  $K_\infty$ -linear endomorphism  $\sigma$ , called Sen's endomorphism, which encodes many properties of the representation. Indeed, the functor  $W \mapsto (V, \sigma)$  is exact and faithful and  $(V, \sigma)$  determines  $W$ . If time permits, I will conclude the lectures with a brief overview of the  $p$ -adic Simpson theory, which can be naturally viewed as the geometric generalization of Sen theory.*

FRÉDÉRIQUE OGGIER

Lattices and codes: arithmetic for communication systems

*In this course we will show how lattices and codes, both independently and jointly, are used in the context of communication systems. The course is structured as follows:*

- Introduction to lattices and geometry of numbers*
- Introduction to linear codes and lattices from codes*
- Introduction to number fields and lattices from number fields*
- Introduction to quaternion algebras and codes from quaternion algebras*
- Practical aspects: channel modeling and decoding.*

MARINE ROUGNANT

Introduction to PARI/GP

*Numerical experiments play a crucial role in mathematical research, whether for computing examples, reinforcing intuition, or formulating conjectures through an exploratory approach. The PARI/GP software is designed for fast computations in arithmetic and number theory. Its collaborative development provides a wide range of efficient tools across various areas of number theory, including algebraic number theory, elliptic curves, modular forms, and L-functions.*

*After a brief introduction to the software's syntax, this course will cover the fundamental functions necessary for using the software at the Master's level. Participants will be invited to practice with exercise sheets and will have the opportunity, upon request, to explore topics more closely related to their research.*



## Advanced preparatory lectures

A series of talks is planned in preparation for Ahmed Abbes' course. These talks will be based on the following two books by J.-P. Serre:

[CL] J.-P. Serre, *Corps locaux*, Hermann, Paris, 1962.

[CG] J.-P. Serre, *Cohomologie Galoisienne*, 5th ed., *Lecture Notes in Mathematics*, vol. 5, Springer, 1997.

These talks will be given by PhD students, postdocs and senior researchers. The first six sessions are led by Vincent Kouakou.

### Monday, March 10

4:30-5:00 Ephraim Poncho-Kotey ([CL] Chapter I)

5:00-5:30 Karim Sankara ([CL], Chapter I)

### Tuesday, March 11

9:15-9:45 Karim Sankara ([CL], Chapter I)

3:15-4:15 Johnathan Djella ([CL], Chapter II, §6)

4:30-5:00 Moustapha Camara ([CL], Chapter II, §1 to 5)

5:00-5:30 Roslan Ibara ([CL], [Chapter II, §1 to 5])

### Wednesday, March 12

9:15-9:45 Aldo Lokossa ([CL], Chapter II, §1 to 5)

2:45-3:45 Copernic Bounougouendji ([CG], Chapter I, Section 2)

4:00-5:00 Hermann Soré ([CG], Chapter I, Section 2)

### Thursday, March 13

9:15-9:45 Demba Barry ([CG], Chapter I, §5)

2:45-3:45 Demba Barry ([CG], Chapter I, §5)

4:00-6:00 Hermann Soré ([CG], Chapter I, Section 2) Demba Barry ([CG], Chapter I, §5)

### Friday, March 14

9:15-10:00 Johnathan Djella ([CL], Chapter II, §6)

### Saturday, March 15

9:00-10:00 Christian Maire ([CL], Chapter IV)

# Promotion of Mathematics

We schedule a series of events to promote mathematics:

- Activities for popularizing mathematics in the framework in the [International Day of Mathematics](#) (on March 14),
- Outreach activities about the gender gap in science in the framework of the International Women’s Day 2025, jointly organized with the *Association des femmes mathématiciennes du Gabon* which is the local branch of the [African Women in Mathematics Association](#) (On March 15),
- We are organizing the Mathematics Olympiad of the ENS Libreville Department on Saturday, March 8, from 9 AM to 10 AM. This competition is open to final-year science students specializing in mathematics from 25 high schools in Libreville (at least 500 students). The top 10 students will receive awards (On March 21).

## Friday, March 14 - Pi Day

- 3:30            Opening by Hervé Nkona, Managing Director of Top Sciences  
3:40 - 3:45    Dr Maurice Obame, Ecole Normale Supérieure (ENS), Gabon  
                  Chair of the Mathematics Departement  
                  *Some ideas to get young students more interested in mathematics*  
3:45-4:15     Pr Frédérique Oggier, University of Birmingham, UK  
                  *Les codes correcteurs d’erreurs*  
4:15 - 4:45    Dr Marine Rougnant, University Marie and Louis Pasteur, France  
                  *Pourquoi j’aime les mathématiques*  
4:45-5:15     Pr. Basile Guy Richard Bossoto, University Marien Ngouabi, Republic of Congo  
                  *President of the African Mathematical Union*  
5:15-5:45     Abdoulaye Boumanga Ba, ArchiSec-IT, Gabon  
                  *Mathematics Applied to Computer Security*  
5:45             $\pi$  decimal recitation contest - Closing

## Saturday, March 15 - International Women’s Day 2025

- 10:00-10:15   Opening by Pr Perrine Mvou, *Director of Studies of ENS*  
10:15-10:35   Dr Isabelle Ngningone, *Université des Sciences et Techniques de Masuku, Gabon*  
                  *Presentation of Gabonese Woman Mathematicians*  
                  *and my career as a mathematician*  
10:35-11:00   Coffee break  
11:00-12:15   My career as a scientist  
                  – Pr Frédérique Oggier, University of Birmingham, UK, Mathematician  
                  – Dr Hermance Moussambi, Ecole Normale Supérieure, Gabon, Physicist  
                  – Dr Marine Rougnant, Univ. Marie and Louis Pasteur, France, Mathematician  
                  – Dr Winnie Ossete, University Marien Ngouabi, Congo, Mathematician  
                  – Dr Armelle Ntsame Affane, Ecole Normale Supérieure, Gabon, Biologist  
                  – Dr Marthe Djieri, Ecole Normale Supérieure, Gabon, Chemist  
12:15-12:45   Round Tables - Closing

## Friday, March 21

- 2:00-3:00    Olympiad Awards - Closing ceremony

# Research lectures and Progress reports

The goal of this sequence is also to review [REDAGAAC activities](#).

## Friday, March 14

1:15-2:00 Idrissa Kaboré

## Monday, March 17

2:00-3:00 Lassina Dembelé (online)

3:15-4:15 Ravi Ramakrishna (online)

## Tuesday, March 18

2:00-2:50 Demba Barry

3:00-3:50 Hermann Soré

4:00-4:30 Abdoulaye Maiga

## Wednesday, March 19

2:00-2:20 Moustapha Camara

2:30-2:50 Brice Miyaoka

3:05-3:25 Roslan Ibara

3:35-3:55 Ephraim Poncho-Kotey

## Thursday, March 20

2:00-2:20 Karim Sankara

2:30-2:50 Johnathan Djella

3:05-3:25 Copernic Boungouendji

3:35-3:55 Aldo Lokossa

4:00-4:15 Tony Ezome & Christian Maire

## Abstracts of the research lectures

BARRY DEMBA, University of Bamako, Mali

Cohomological invariants of quadratic forms and algebras with involution

*(Joint work with A. Masquelein and A. Quéguiner-Mathieu). In this talk we present some classical cohomological invariants for quadratic forms and explain why the absolute Arason invariant does not extend to algebras with involution. As for orthogonal involutions, using the Rost invariant for some torsors, we define a relative Arason invariant for unitary involutions. The last part of the talk will be devoted to the properties of this relative invariant for algebras of degree 4 and 8.*

CAMARA MOUSTAPHA, University Assane Seck of Ziguinchor, Sénégal

Points algébriques sur certaines courbes planes lisses

*Étant donné  $\mathcal{C}$ , une courbe projective irréductible et lisse définie sur  $\mathbb{Q}$  de genre  $g$ , la célèbre conjecture de Mordell prédit que lorsque  $g \geq 2$ , la courbe  $\mathcal{C}$  possède un nombre fini de solutions dans un corps de nombres donné. Dans cette présentation, nous retracerons cette histoire puis nous nous intéresserons à la détermination des points algébriques de degré donné sur certaines courbes planes lisses de genre au moins deux.*

DEMBELÉ LASSINA, King's College, London, UK

Parametrising abelian surfaces with  $RM$  by  $\mathbb{Z}[\sqrt{2}]$  using Richelot isogenies

*In this talk, we describe a parametrisation of abelian surfaces with real multiplication by  $\mathbb{Z}[\sqrt{2}]$  using Richelot isogenies, and give some arithmetic applications.*

RAMAKRISHNA RAVI, Cornell University, USA (online)

The Inverse Galois Problem

*Given a polynomial  $f(x)$  with rational coefficients, we can let  $K$  be its splitting field and try to compute the finite group  $\text{Gal}(L/\mathbb{Q})$ . The Inverse Galois Problem (it's really a Conjecture!) asserts that every finite group  $G$  is realizable as  $\text{Gal}(K/\mathbb{Q})$  for some finite extension  $K/\mathbb{Q}$ . I will survey this problem, the progress to date on it, and some of its variants.*

SORÉ HERMANN, Nazi Boni University, Burkina Faso

On a Quillen adjunction between the categories of differential graded and symplectic coalgebras

*We prove that the normalization functor of the Dold-Kan correspondence does not induce a Quillen equivalence between Goerss' model category of simplicial coalgebras and Getzler-Goerss' model category of differential graded coalgebras.*



# Participants



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