Algebraic Days of Gabon
6th Edition

École Normale Supérieure

Libreville, Gabon

March 16-27, 2026

Coordinators

Tony Ezome †, École Normale Supérieure de Libreville, Gabon
Christian Maire, University Marie and Louis Pasteur, France
Maurice Saint Clair Obame Nguema, École Normale Supérieure de Libreville, Gabon
Winnie Ossete, Université Marien Ngouabi, Brazzaville, Republic of Congo

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website of the event

In tribute to

our dear friend Tony

The Algebraic Days of Gabon, 6th Edition will take place in École Normale Supérieure (ENS) in Libreville, Gabon, from March 16 to 27, 2026. It will consist of three main activities:

- **CIMPA Collaborative workshop and advanced course**. The program will consist of one course on *Arithmetic Groups* by Aurel Page, INRIA and University of Bordeaux, France [second week]. During the first week, there will be *advanced preparatory lectures* for this course. These lectures will be accompanied by preparation sessions (first week) and exercise sessions (second week). This Advanced Course is part of a CIMPA Collaborative Workshop.
- **Research and advanced lectures.** Lectures given by Researchers, and by master and PhD students.
- **A series of events to promote mathematics.**
  - Outreach activities about the gender gap in science in the framework of the International Women's Day 2026, jointly organized with the *Association des femmes mathématiciennes du Gabon* which is the local branch of the African Women in Mathematics Association,
  - A round table led by Cécile Armana, University of Lille, on *Open Science and access to mathematical resources*.
  - 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 special support from the CIMPA, France.

The event will include several sessions in tribute to Tony.
– During the opening of the event, several speeches are planned.
– The afternoon of Monday, March 23. We are planning three research talks given by the most recent PhD students of Tony. The afternoon will conclude with a discussion on the future of ANAGA.

	9-9:45	10-11	11:15-12:15	2:00-3:00	3:15-4:15	4:30-5:30
March 16		opening	opening			
March 17	preparation					
March 18	preparation					
March 19	preparation					Open Science
March 20	preparation					
March 21		Women Day'26	Women Day'26			
March 23				Tributes to	Tony	ANAGA
March 24						
March 25	exercises					
March 26	exercises					
March 27	exercises				olymp. awards	closing

Advanced Course

This course is 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 course is given by Aurel Page, INRIA and University of Bordeaux, France. It is supported by https://www.cimpa.info/ in the form of a CIMPA Collaborative Workshop.

Abstract

Aurel PAGE

Equidistribution of Hecke orbits and applications

I will first introduce Hecke operators on arithmetic manifolds from several points of view. I will then explain the notion of equidistribution, relating it to strong approximation and to classical properties of modular forms in the case of Hecke orbits. Finally I will present several applications, in particular algorithmic ones.

Advanced preparatory lectures

A series of talks is planned in preparation for Aurel Page' course.
They will be accompanied by preparation sessions (first week) and exercise sessions (second week).
These talks will be given by PhD students and postdocs. They were supervised by experienced researchers.
The talks were divided into three themes.

A **- Algebraic Groups**
Coordinators: Demba Barry and Hermann Soré.
Participants (8): Ibraim Nonkane, Brice Miyaoka, Roslan Ibara, Derille Kouemo, Copernic Boungouendji, Eric Bapack, Graciel Essono, Cédric Midianga.

B **- Global fields**
Coordinators: Cécile Armana, Anne Hanwa and Abdoulaye Maiga
Participants (8): Euloge Tchammou, Joseph Fomekong, Karim Sankara, Deborah Amani, Geordann Igouwe, Pierre Ebayi, Fermi Adrien Memiaghe, Gylain Ovono Allogo.

C **- Idèles, Adèles and Approximation**
Coordinators: Moustapha Camara, Vincent Kouakou and Christian Maire
Participants (8): Johanathan Djella, Bénédicte Nzi, Aldo Lokossa, Josepha Nguema, Ephraim Poncho-Kotey, Beni Ibara, Jean-Baptiste Mebale Engohang, Seguy Mihindou.

These talks will be based on the following books:

J.W.S. Cassels, A. Fröhlich, Algebraic Number Theory, Academic Press, London, 1967

V. Platonov, A. Rapinchuk, Algebric Groups and Number Theory, English translation, Academic Press, 1994.

P. Samuel, Théorie algébrique des nombres, Hermann Paris, 1967.

J.-P. Serre, Cours d'arithmétique, GTM 7, Springer, 1973.

T.A. Springer, Linear Algebraic Groups, MBC, Birkhäuser Boston, 1998.

Monday, March 16

2:00-3:00	Copernic Bougouendji - *Rappels sur les variétés affines*
3:15-4:15	Joseph Fomekong - *Anneaux de Dedekind, factorisation des idéaux*

Tuesday, March 17

10-11	Gylain Ovono Allogo - *Corps de nombres, anneau des entiers, discriminant*
11:15-12:15	Euloge Tchammou - *Idéaux fractionnaires, groupe des classes d'idéaux*
2:00-3:00	Fermi Adrien Memiaghe - *Décomposition d'un idéal premier dans une extension*
3:15-4:15	Roslan Ibara - *Groupes algébriques*
4:30-5:30	Beni Ibara - *Valuation, completion and Ostrowski Theorem*

Wednesday, March 18

10-11	Brice Miayoka - *Exemples de groupes algébriques*
11:15-12:15	Eric Bapack - *Quelques résultats de base*
2:00-3:00	Bénédicte Nzi - *Hensel Lemma, applications*
3:15-4:15	Ephraim Poncho-Kotey - *Hasse-Minkowski Theorem*
4:30-5:30	Derille Kouemo - *G-Spaces*

Thursday, March 19

10-11	Ibrahim Nonkane - *Restriction des scalaires, espaces tangents*
11:15-12:15	Josepha Nguema - *Some consequences of Hasse-Minkowski Theorem*
2:00-3:00	Déborah Amani - *Cas des corps quadratiques*
3:15-4:15	Jean-Baptiste Mebale - *The Hilbert symbol*

Friday, March 20

10-11	Aldo Lokossa - $\mathbb{Q}_p$ *and its extensions*
11:15-12:15	Pierre Ebayi - *Plongement canonique et finitude du groupe des classes*
2:00-3:00	Johnathan Djella, Seguy Mihindou - *Adèles, Idèles, and Approximation*
3:15-4:15	Karim Sankara - *Théorème des unités de Dirichlet*
4:15 - 5	Geordann Igouwe - *Discriminant et ramification*

Monday, March 23

9-9:45 Ibrahim Nonkane - *Algèbre de Lie d'un groupe algébrique*

Tuesday, March 24

9-9:45 Hermann Soré - *Groupes diagonalisable et tores*

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),
- A round table led by Cécile Armana, University of Lille, on *Open Science and access to mathematical resources* (On March 20).
- Outreach activities about the gender gap in science in the framework of the International Women's Day 2026, jointly organized with the *Association des femmes mathématiciennes du Gabon* which is the local branch of the African Women in Mathematics Association (On March 21),
- We are organizing the Mathematics Olympiads of the ENS Libreville Department on Saturday, March 14, from 9 AM to 10 AM. This competition is open to final-year science students specializing in mathematics from high schools in Libreville. The top 10 students will receive awards (On March 27).

Friday, March 14 - Pi Day

– Mathematics Olympiads organized by the Department of Mathematics at the École Normale Supérieure, Libreville.
– Series of presentations at the Top Sciences Association.

Thursday, March 19 - Open Science and access to mathematical resources

4:30-5:30 Round-table discussion led by Professor Cécile Armana, University of Lille, France

Saturday, March 21 - International Women's Day 2026

– Round table discussion
– Lectures
– Visit to the departments

Friday, March 27

3:00-5:00 Olympiad Awards - Closing ceremony

Research lectures

Monday, March 23

2:00-2:25 Johnathan Djella
2:30-2:55 Ephraim Poncho-Kotey
3:15-3:40 Brice Miyaoka

Tuesday, March 24

2:00-2:25 Jules Tindzogho
2:30-2:55 Abdoulaye Maiga
3:15-3:40 Euloge Tchammou
3:45-4:10 Aldo Lokossa
4:30-4:55 Copernic Boungouendji

Wednesday, March 25

2:00-2:25 Vincent Kouakou
2:30-2:55 Moustapha Camara
3:15-3:40 Karim Sankara
3:45-4:10 Abdoulaye Boumanga Ba
4:30-4:55 Déborah Amani
5:00-5:25 Pierre Ebayi

Thursday, March 26

2:00-2:25 Hermann Soré
2:30-2:55 Ibrahim Nonkane
3:15-3:40 Geordann Igouwe
3:45-4:10 Joseph Fomekong
4:30-4:55 Cédric Midianga
5:00-5:25 Koel Lemondo

Friday, March 27

2:00-2:25 Demba Barry

Abstracts of the research lectures

AMANI FARAJA Déborah, Université de Bukavu, Democratic Republic of Congo

On some Algebraic Number Theory aspects of SIC-POVMs

Sic povms are some special quantum measurements. In this talk, we present a way of constructing them using a group covariance property. We also present some of their algebraic aspects.

BARRY Demba, University of Bamako, Mali

Trialitarian triples

Trialitarian triples are triples of central simple algebras of degree 8 *with orthogonal involution that provide the groundwork for the study of algebraic groups of trialitarian type* $D4$*. A cohomological approach in the Book of Involutions reveals the existence (non-explicit) of an operator of order* 3 *that induces a cyclic operation on trialitarianc triples. In this talk, we propose an explicit (cohomology-free) approach based on the compositions of quadratic spaces. This allows to elucidate the trialitarian isomorphisms between* $D4$ *algebraic groups. Joint work with J.-P. Tignol.*

BOUMANGA BA Abdoulaye, ArchiSec-IT, Gabon

Mathématiques des PKI et Souveraineté Numérique

Les infrastructures à clé publique (PKI) reposent sur des problèmes fondamentaux en théorie des nombres et en géométrie algébrique, tels que la factorisation entière et le logarithme discret sur courbes elliptiques. Cet exposé examine leur structure mathématique et montre en quoi la maîtrise de ces primitives conditionne la souveraineté numérique d'un État, notamment dans le contexte de la transition post-quantique.

BOUNGOUENDJI Copernic, Université Marien Ngouabi, République du Congo

Passage du H^2 global au H^2 local

Dans cet exposé, nous présentons une stratégie pocohomologique pour étudier les groupes de Galois $\widetilde{G}_S^T$ *attachés à la* $\mathbb{Z}_p$*-extension cyclotomique d'un corps de nombres* K*. L'objectif est de maîtriser le second groupe de cohomologie* $H^2(\widetilde{G}_S^T, \mathbb{F}_p)$ *en le comparant à des* H^2 *locaux via un morphisme de restriction. L'obstruction à l'injectivité de cette comparaison est mesurée par un noyau de Shafarevich. En choisissant habilement l'ensemble* S *des places ramifiées, on peut annuler ce noyau rendant ainsi l'injectivité effective.*

CAMARA Moustapha, University Assane Seck of Ziguinchor, Sénégal

À la recherche des points algébriques de petit degré sur la septique de Fermat

Les courbes de Fermat jouent un rôle central en géométrie algébrique et en théorie des nombres. Dans cet exposé, nous étudions la courbe de Fermat de degré sept, appelée septique de Fermat, définie par l'équation projective

$$X^7 + Y^7 = Z^7.$$

Nous nous intéressons à l'existence de points algébriques de petit degré sur cette courbe. Plus précisément, étant donnée une extension de corps de nombres $K/\mathbb{Q}$, nous examinons l'existence de points $K-$rationnels sur la septique de Fermat lorsque le degré $[K : \mathbb{Q}]$ est petit. Nous montrons qu'il n'existe pas de points algébriques de degré 3, 4 *ou* 5 *sur cette courbe.*

DJELLA Johnathan, Université de Zinguichor Assane Seck, Sénégal

Geometric value of Galois pseudo-primality test

This talk, we compute functions that bound from above and from below geometric means of the number of bad witnesses for the Galois pseudo-primality test, which involves on cyclic ring extensions. We start by recalling some known results on Galois ring extensions, set of bad witnesses, and then discuss on bounds..

EBAYI Pierre, Universté des Sciences et Techniques de Masuku, Gabon

An Important Exact Sequence for the Proof of the Scholz-Reichardt Theorem

In this talk, we study a fundamental relationship between Galois cohomology and Selmer groups. More precisely, we present an important exact sequence that plays a key role in the proof of the Scholz-Reichardt theorem.

FOMEKONG Joseph, University of Bamenda, Cameroon

Post-Quantum Signatures via Rank Syndrome Decoding from the RYDE Protocol to Semi-Equivalence with the Rank Metric

We present a post-quantum signature scheme based on the hardness of the Rank Syndrome Decoding (RSD) problem. Building on the RYDE *protocol and the MPC-in-the-Head paradigm, we introduce a new hard problem called Semi-Equivalence with Rank (SER), which generalizes RSD from a secret vector to a matrix with bounded-rank columns. Kronecker vectorization and column-wise DSM decomposition provide the mathematical tools for an efficient arithmetization toward a complete, NIST-compatible signature scheme.*

IGOUWE Geordann, USTM, Gabon

Hopf Algebras, Group Schemes, and Models of Roots of Unity

A group scheme is a group object within the category of schemes. It provides a geometric structure where multiplication, identity, and inversion are defined as morphisms. An affine group scheme corre- sponds uniquely to the spectrum of a commutative Hopf algebra—that is, a bialgebra equipped with an antipode. In this talk, I will define these fundamental notions and provide illustrative examples. I will then present an open question relating to the explicit description of the group scheme associated to p^n-th roots of unity, alongside a strategy to address it. This is work in progress under the supervision of H. Sore and A. Mézard.

KOUAKOU Vincent, Université Nangui Abrogoua, Côte d'Ivoire

From The Geometry of The Square to Elliptic Curves: A Bridge Via D_4 to S_3 Actions

We construct an explicite bridge between the geometry of the square and the arithmetic of elliptic curves via group actions on the projective line. Starting from the classical parametrization of primitive Pythagorean $(t^2-1, 2t, t^2+1)$, we introduce a semi-invariant rational function defined solely in terms of the triangle, wich leads to the construction of a dihedral invariant f_{D_4}. This invariant defines a Galois covering of $\mathbb{P}^1$ and prepares the transition from the dihedral group D_4 to the symmetric group S_3, acting on the Legendre parameter space. We obtain a Lüroth tower encoding successive symmetry reductions. As application, we associate a dessin d'enfants reflecting the square symmetry, thereby establishing an explicit path between the geometry of the square and the arithmetic of elliptic curves.

LEMONDO Koel, Libreville, Gabon

Cryptography Protocole Based on Bilinear Pairings: Kyung-Ah Shim Ring Signature

MAIGA Abdoulaye, École Normale Supérieure de Bamako, Mali

Isogeny Graph and Postquantum Diffie-Helman Protocol

The development of quantum computing tools has rendered obsolete security protocols based on difficult problems such as the discrete logarithm and integer factorization. In 1997, J.M. Couveignes proposed a Diffie-Hellman protocol based on the difficulty of finding isogeny between two vertices on the crater of ordinary elliptic curves volcanoes. These results proved very promising, and from 2006 to the present day, several cryptographic protocols based on highly diverse problems on isogeny graphs have been developed, problems that no quantum computing tool can solve in polynomial time. In this talk, we detailed analyses of the CSIDH and OSIDH protocols, along with some very promising improvements for their use in post-quantum key exchange.

MIDIANGA NOUATIN Cédric Sèdjro, USTM, Gabon

β-représentations, automates et fractales : entre dynamiques symboliques et géométries auto-similaires

Ce travail analyse les liens entre arithmétique, informatique théorique et géométrie fractale via les développements en base réelle $\beta > 1$. L'auteur utilise le théorème de Parry pour caractériser les suites admissibles et construire des automates finis, notamment pour les nombres de Parry où le développement de 1 est périodique. Ces structures symboliques sont reliées aux fractales auto-similaires, comme les tapis de Rauzy ou l'ensemble de Tribonacci, conçues comme attracteurs de systèmes de fonctions contractantes (IFS). L'étude démontre comment la complexité combinatoire des suites dicte la géométrie et la dimension de Hausdorff de ces objets.

MIYAOKA Brice, Université Marien Ngouabi, République du Congo

Isolated quadratic points on hyperelliptic curves of rank 0 and genus 2

We present a method for computing and isolated quadratic points on hyperelliptic curves of genus 2 whose Jacobians have rank 0. Our approach begins by computing the image of the Mordell-Weil group on the associated Kummer variety and then determining which of these points correspond to rational or isolated quadratic points on the curve. We have developed and implemented this algorithm using the computer algebra system Magma. The method takes advantage of structural properties specific to hyperelliptic curves and their Jacobians. We applied our algorithm to a large dataset, $12,075$ genus 2 hyperelliptic curves.

NONKANE Ibrahim, Université Thomas Sankara, Burkina Faso

A kind of Howe duality between a wreath product and algebra of invariant differential operators

In this talk, we investigate a kind of Howe duality between generalized symmetric group and algebra of invariant differential operators. In this vein, we study polynomial rings as modules over a ring of invariant differential operators by elaborating its irreducible submodules. We prove that the irreducible D-submodules of the direct image are in one-to-one correspondence with irreducible representations of G. We study the decomposition structure for G equal to a wreath product.

PONCHO KOTEY Ephraim, University of Ghana, Ghana

Computing Discrete Logarithms From Intersection Theory on Surfaces

Discrete logarithms algorithms has been developed over the years by a lot of mathematicians because of its link with cryptography. In this talk we will talk about intersection theory, some sieving algorithms and some introduction to curves and surfaces. We will also investigate how those concepts helps in the computation of discrete logarithms.

SANKARA Karim, Nazi Boni University, Burkina Faso

On the inverse Galois problem for Hilbert p-class field and S-p-class field tower

In this talk, we simultaneously address the inverse Galois problem for the Hilbert p-class field tower and S-p-class field tower. The goal is to show that, given a p-group G, a normal subgroup H of G, a number field K with trivial p-class group, and a finite nonempty set S of places of K, there exists an extension F/K, S-split, such that the unramified Hilbert p-class field tower of F has Galois group G, and the S-Hilbert p-class field tower of F has Galois group G/H. This extends the results of Ozaki, of Hajir-Maire-Ramakrishna, and Maire-Sankara.

SORÉ Hermann, Nazi Boni University, Burkina Faso

On the Sweedler dual functor

While the linear dual of a coalgebra over a field produces an algebra, the reverse process does not work when considering an infinite dimensional algebra. A functor introduced by Sweedler corrects this failure, but still has some computationability issues. In this talk, we will define the Sweedler dual functor and give some computable examples. We will also address some questions of interaction between the Sweedler dual and cohomology, analogously to the cohomological version of the Universal Coefficient Theorem.

TCHAMMOU Euloge, IMSP, Bénin

On the Diophantine equation $\sum_{j=1}^{m} jF_{k,j}^2 = F_{k,n}^q$

In this presentation, we find all the solutions of the Diophantine equation $F_{k,1}^2 + 2F_{k,2}^2 + \cdots + mF_{k,m}^2 = F_{k,n}^q$ in positive integer variables (m, n), where $q \in \{1, 2\}$, k a positive integer and $F_{k,i}$ is the i^{th} term of the k^{th} Fibonacci sequence defined by

$$F_{k,0} = 0,\ F_{k,1} = 1 \text{ and } F_{k,n} = kF_{k,n-1} + F_{k,n-2}, \quad \text{for} \quad n \geq 2.$$

TINDZOGHO NTSIRI JULES, Universté des Sciences et Techniques de Masuku, Gabon

Lie rings in model theory

In this talk, we discuss the study of Lie rings in model theory that are equipped with a dimension called the Morley rank*, which gives them interesting properties similar to those of Lie K-algebras. In an article published with Adrien Deloro, where we show, for example, that simple Lie rings up to dimension 4 are Lie K-algebras, a list of open research questions is outlined. This will also be an opportunity for us to present these interesting questions and discuss current research on them.*

Participants

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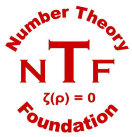


March 27, 2026