Iwawasa 2023
In Memory of John Coates

17–21 July 2023

University of Cambridge

Organisers:

Vladimir Dokchitser (UCL), Tom Fisher (Cambridge), Yukako Kezuka (Jussieu), Masato Kurihara (Keio), Peter Schneider (Münster), Ye Tian (Morningside Centre), Sarah Zerbes (ETH Zürich)

Overview:

This is the ninth Iwasawa conference following conferences in Besancon, Limoges, Irsee, Toronto, Heidelberg, London, Tokyo and Bordeaux.
The conference is dedicated to the memory of John Henry Coates.

Location:

The conference will take place at the Centre for Mathematical Sciences (CMS) on Wilberfore Road. All talks will take place in Meeting Room 2 (MR2) at the CMS, with an overflow in MR3. Both rooms are at basement level, and step-free access is available using the lifts in Pavilions D and G. Registration, coffee breaks, lunches, and the Monday evening reception will be at ground level – in the "Central Core".

Practical Information:

Wifi tickets (for those not using Eduroam) will be available from the conference registration desk and from CMS reception. On the day of your departure, bags may be left in MR1 near CMS reception (Monday to Friday).

Speakers:

Mirela Ciperiani (Austin)	Kazuya Kato (Chicago)	Leila Schneps (Jussieu)
Pierre Colmez (Jussieu)	Yukako Kezuka (Jussieu)	Jacques Tilouine (Paris XIII)
Matthias Flach (Caltech)	David Loeffler (Warwick)	Otmar Venjakob (Heidelberg)
Ralph Greenberg (Seattle)	Barry Mazur (Harvard)	Andrew Wiles (Oxford)
Guy Henniart (Orsay)	Bill McCallum (Arizona)	Gergely Zábrádi (Budapest)
Luc Illusie (Orsay)	Bernadette Perrin-Riou (Orsay)	Shouwu Zhang (Princeton)
Mahesh Kakde (Bangalore)	Cristian Popescu (San Diego)	

Coates Memorial Conference Schedule

MONDAY 17 JULY

8:30-9:30	Registration and Welcome
9:30-10:30	Bernadette Perrin-Riou (Orsay)
10:30-11:00	Coffee Break
11:00-12:00	Pierre Colmez (Jussieu)
12:00-14:15	Lunch
14:15-15:15	Leila Schneps (Jussieu)
15:15-15:45	Coffee Break
15:45-16:45	Guy Henniart (Orsay)
17:00-18:15	Reminiscences
18:15-20:00	Reception

TUESDAY 18 JULY

9:30-10:30	Kazuya Kato (Chicago)
10:30-11:00	Coffee Break
11:00-12:00	Yukako Kezuka (Jussieu)
12:00-13:45	Lunch
13:45-14:45	Jacques Tilouine (Paris XIII)
15.00-16.00	David Loeffler (Warwick)
16:00-16:30	Coffee Break
16:30-17:30	Andrew Wiles (Oxford)

WEDNESDAY 19 JULY

9:30-10:30	Ralph Greenberg (Seattle)
10:30-11:00	Coffee Break
11:00-12:00	Matthias Flach (Caltech)
12:15-13:15	Gergely Zábrádi (Budapest)
13:15-13:30	Conference Photo
13:30-	Lunch and Free Afternoon

THURSDAY 20 JULY

9:30-10:30	Luc Illusie (Orsay)
10:30-11:00	Coffee Break
11:00-12:00	Otmar Venjakob (Heidelberg)
12:00-13:45	Lunch
13:45-14:45	Bill McCallum (Arizona)
15:00-16:00	Cristian Popescu (San Diego)
16:00-16:30	Coffee Break
16:30-17:30	Mahesh Kakde (Bangalore)

FRIDAY 21 JULY

9:30-10:30	Barry Mazur (Harvard)
10:30-11:00	Coffee Break
11:00-12:00	Mirela Ciperiani (Austin)
12:15-13:15	Shouwu Zhang (Princeton)
13:15	Departure — No Lunch

Titles and Abstracts

Mirela Ciperiani (University of Texas at Austin)

Title: Local/global trace relations on elliptic curves and related statistical results

Abstract: Let E be an elliptic curve over $\mathbb{Q}$ and $K/\mathbb{Q}$ a quadratic extension. We will consider the trace map from $E(K)$ to $E(\mathbb{Q})$ and discuss related questions and implications.

Pierre Colmez (Sorbonne Université, IMJ-PRG)

Title: A factorization of the system of Beilinson–Kato

Abstract: I will explain how to factorize the system Beilison–Kato elements into a product of two modular symbols: an algebraic incarnation of the Rankin–Selberg method. This factorization rests upon Emerton's factorization of the completed cohomology of the tower of modular curves for which I will explain a new proof. This is joint work with Shanwen Wang.

Matthias Flach (California Institute of Technology)

Title: Special values of Zeta functions

Abstract: We formulate a conjecture which describes special values of Zeta functions of proper regular arithmetic schemes up to sign. Unlike previous work in this area our conjecture makes no use of p-adic Hodge theory. We discuss some evidence: Compatibility with BSD, compatibility with the functional equation, proof for integer rings of abelian number fields. This is joint work with B. Morin, developing ideas originally due to Lichtenbaum.

Ralph Greenberg (University of Washington, Seattle)

Title: Remarks about Some Pseudo-Null Modules in Iwasawa Theory

Abstract: The mathematical part of this talk will describe some recent joint work with Frauke Bleher, Ted Chinburg, Mahesh Kakde, Romyar Sharifi, and Martin Taylor concerning Iwasawa theory for an imaginary quadratic field. A certain classical Iwasawa module which occurs in that theory should conjecturally be pseudo-null (i.e. have no primes ideals of height 1 in its support.) Our ongoing work shows that the primes ideals of height 2 in its support (and, more precisely, the 2nd Chern class of that module) are the same as those in the support of another module constructed from elliptic units. I also will share a number of memories from my long friendship with John Coates.

Guy Henniart (Université Paris-Saclay)

Title: Swan exponents and tensor operations

Abstract: This is joint work with Colin Bushnell, and, more recently, with Masao Oi in Kyoto. Let F be a p-adic field for some prime number p, F^{ac} an algebraic closure of F, and G_F the Galois group of F^{ac}/F. A continuous finite dimensional representation σ (on a complex vector space W) has a Swan exponent $s(\sigma)$, a non-negative integer which measures how "wildly ramified" σ is.

Langlands functoriality makes it of interest to compare $s(\sigma)$ and $s(r \circ \sigma)$ when r is an algebraic representation of $\mathrm{Aut}_{\mathbb{C}}(W)$. The first cases for r are the determinant, the adjoint representation, the symmetric square representation and the alternating square representation. I shall give some relations (inequalities mostly, with equality in interesting cases) between the Swan exponents of those representations $r \circ \sigma$. I shall also indicate how such relations can be used to explicit the local Langlands correspondence of Arthur for some simple cuspidal representations of split classical groups over F.

Luc Illusie (Université Paris-Saclay)

Title: New developments in de Rham cohomology in mixed characteristic, after Bhatt–Lurie, Drinfeld, and Petrov.

Abstract: Bhatt–Scholze's prismatic cohomology and Bhatt–Lurie–Drinfeld's prismatic stacks have led to the discovery of mysterious structures on de Rham cohomology in mixed characteristic. These, in turn, enabled Petrov to solve a 1987 question on the Hodge to de Rham spectral sequence of proper, smooth varieties over a field of positive characteristic. I will describe these new structures and sketch the key ideas in Petrov's work.

Mahesh Kakde (Indian Institute of Science, Bangalore)

Title : On the Brumer-Stark conjecture at $p = 2$.

Abstract: in this talk I will sketch proof of the Brumer-Stark conjecture at $p = 2$. The main new ingredient is the proof of Ribet's lemma in residual y indistinguishable case. This is a joint work with Samit Dasgupta, Jesse Silliman and Jiuya Wang.

Kazuya Kato (University of Chicago)

Title: K_2 ideles and height pairings.

Abstract: I will talk about the work of my student Yuhui Yao. (I myself could not get a good result for this conference in time.)
For a curve over a number field, she relates the K_2-idele class group (which was originally used for the 2 dimensional class field theory) to the height pairing and (the ordinary case of) the p-adic height pairing.

Yukako Kezuka (Sorbonne Université, IMJ-PRG)

Title : Non-vanishing theorems for central L-values

Abstract: We prove non-vanishing theorems for the central values of L-series of quadratic twists of the Gross elliptic curve with complex multiplication by the imaginary quadratic field $\mathbb{Q}(\sqrt{-q})$, where q is any prime congruent to 7 modulo 8. This completes the non-vanishing theorems proven by Coates and the Li in which the primes q were taken to be congruent to 7 modulo 16. From this, we obtain the finiteness of the Mordell–Weil group and the Tate–Shafarevich group for these curves. This is joint work with Yong-Xiong Li.

David Loeffler (University of Warwick)

Title: Iwasawa theory for the symmetric square of an elliptic curve

Abstract: The arithmetic of the adjoint, or symmetric square, of an elliptic curve over $\mathbb{Q}$ (or, more generally, of a modular form) is a particularly interesting case from the viewpoint of Iwasawa theory, not least because of its close connection with modularity-lifting problems and hence with Fermat's last theorem. In this talk I will describe ongoing work with Sarah Zerbes in which we prove the cyclotomic Iwasawa main conjecture in this setting, using Euler systems for Hilbert modular surfaces.

Barry Mazur (Harvard University)

Title: An Experiment in Class Field Theory

Abstract: For a number field F Class Field Theory connects appropriate 'double quotients'—related to the reductive group $G = \mathrm{GL}(1)$ and the field F—with the Galois groups of abelian extensions of F. The connection is given by a canonical surjection of the (appropriate) double quotient onto the corresponding abelian Galois group—where the maximal connected subgroup of that double quotient appears as the kernel of that surjection.

　　Following what is now a standard route—i.e., passing to a derived context—Tony Feng, Michael Harris, Arpon Raksit and I define an enhancement of the abelian Galois group of a field extension—a certain abelian simplicial group which in the context of CFT 'captures' that kernel—it being in a canonical homotopy equivalence with the corresponding double quotient taken as the homotopy type of a locally compact topological group. We do this in hopes that it may offer some hint as to how to make a similar construction for more general reductive groups.

Bill McCallum (University of Arizona)

Title: A geometric interpretation of classical criteria for Fermat curves

Abstract: Consider the curve $F_s : y^p = x^s(1 - x)$ for integers $1 \leq s \leq p - 2$. This is a quotient of the Fermat curve $x^p + y^p = 1$, and its Jacobian J_s is an abelian variety with complex multiplication by $\mathbb{Z}[\zeta]$, where ζ is a primitive p-th root of unity. Let $K = \mathbb{Q}(\zeta)$ and let $\pi = 1 - \zeta$. We examine the relations between the descent maps
$$J_s(K)/\pi^n J_s(K) \to H^1(K, J[\pi^n])$$
and classical criteria for Fermat's Last Theorem, making use of computations on affinoid subspaces of $F_s(\mathbb{C}_p)$.

Bernadette Perrin Riou (Université Paris-Saclay)

Title: Théorie d'Iwasawa, régulateurs p-adiques

Abstract: On rappellera quelques outils utilisés pour l'étude des fonctions L p-adiques algébriques associées à une représentation p-adique sur un corps de nombres en insistant sur la partie locale et l'espace dans lequel elles devraient être définies.

Cristian Popescu (University of California San Diego)

Title: An Unconditional Equivariant Main Conjecture and Applications

Abstract: I will discuss my recent joint work with Rusiru Gambheera, leading to an unconditional proof of an Equivariant Main Conjecture for the Selmer modules of number fields defined by Burns–Kurihara–Sano. As an application, I will discuss our unconditional proof of the refined Coates–Sinnott Conjecture on Fitting ideals of even Quillen K-groups of number fields. Our work relies on and improves upon the recent breakthrough results of Dasgupta–Kakde on the Brumer–Stark Conjecture, on which I will comment very briefly.

Leila Schneps (Sorbonne Université, IMJ-PRG)

Title: Looking at the absolute Galois group through a geometric lens: elliptic curves, zeta values and modular forms

Abstract: Studying the absolute Galois group via its action on geometric objects can provide a new angle. We will look at information that can be obtained by considering its action on moduli spaces of curves, especially in the key case of genus one, and then show how moving from profinite to pro-unipotent completions leads to surprising direct connections between the structure of the absolute Galois group and various familiar ingredients from number theory.

Jacques Tilouine (Université Sorbonne Paris Nord)

Iwasawa-theoretic derived deformation rings and adjoint Selmer groups

Abstract: In a joint work with Eric Urban, we define in the ordinary case an Iwasawa-theoretic version of a Galatius–Venkatesh homomorphism which maps the first fundamental group of a derived deformation ring into an adjoint Selmer group, with a Tate–Shafarevich group as cokernel. Assuming the control of this cokernel, we find the rank of this fundamental group over the Iwasawa algebra.

Otmar Venjakob (Heidelberg University)

Titel: ϵ-isomorphisms for analytic (φ_L, Γ_L)-modules over Lubin-Tate Robba rings

Abstract: Inspired by Nakamura's work on ϵ-isomorphisms for (φ, Γ)-modules over (relative) Robba rings with respect to the cyclotomic theory we formulate an analogous conjecture for L-analytic Lubin-Tate (φ_L, Γ_L)-modules over (relative) Robba rings for any finite extension L of $\mathbb{Q}_p$. In contrast to Kato's and Nakamura's setting, our conjecture involves L-analytic cohomology instead of continuous cohomology within the generalized Herr complex. Similarly, we restrict to the identity components of D_{cris} and D_{dR}, respectively. For rank one modules of the above type or slightly more general for trianguline ones, we construct ϵ-isomorphisms for their Lubin–Tate deformations satisfying the desired interpolation property. This is joint work with Milan Malcic, Rustam Steingart and Max Witzelsperger.

Andrew Wiles (University of Oxford)

Title: Coates and CM elliptic curves

Abstract: I will talk about our joint work on BSD for CM elliptic curves.

Gergely Zábrádi (Eötvös Loránd University, Budapest)

Title: Multivariable (φ, Γ)-modules and Iwasawa theory

Abstract: In the first half of the talk I recall the motivation for multivariable (φ, Γ)-modules coming from the p-adic Langlands programme and outline the proof—via perfectoid spaces—of a Fontaine-style equivalence of categories with representations of products of Galois groups (this part is joint work with Carter and Kedlaya). In the second half of the talk (joint work—partly in progress—with Aprameyo Pal) I show how to pass to Robba-style versions via overconvergence. The group cohomology can also be computed from the generalized Herr complex over the multivariate Robba ring. We next show how to relate these cohomology groups to the classical Galois-cohomology of tensor products of representations. The analytic Iwasawa cohomology (computed also from a generalized Herr-complex) will hopefully be useful for the (re)formulation of Bloch-Kato exponential maps (which will rather have the form of a spectral sequence) in this setting.

Shouwu Zhang (Princeton University)

Title: Gross–Zagier for Shimura three folds

Abstract: I will discuss various types of Gross–Zagier type formulas for heights of special 1-cycles on Shimura 3-folds.

Coates Memorial Conference Participants

Tom	Adams	University of Cambridge
Adebisi	Agboola	UC Santa Barbara
Horawa	Aleksander	University of Oxford
Abdulmuhsin	Alfaraj	University of Bath
Alberto	Angurel Andres	University of Nottingham
Lawrence	Arscott	University of Edinburgh
Mahiro	Atsuta	Tsuda University
Miguel Eduardo	Bautista Ocampo	Instituto Politécnico Nacional
Jamie	Bell	University College London
Jean-Robert	Belliard	Université de Franche-Comté
Bryan	Birch	University of Oxford
Frauke	Bleher	University of Iowa
Thanasis	Bouganis	Durham University
Ali	Boukaroura	Ecole Normale Supérieure de Setif
Gudrun	Brattström	Stockholm University
Dominik	Bullach	King's College London
Kevin	Buzzard	Imperial College London
Dongho	Byeon	Seoul National University
Sven	Cats	University of Cambridge
Marsault	Chabat	Université de Franche-Comté
Adithya	Chakravarthy	University of Toronto
Qin	Chao	Harbin Engineering University
Guan-Ting	Chen	National Tsing Hua University
Ryan	Chen	Massachusetts Institute of Technology
Shih-Yu	Chen	Kyoto University
Hung	Chiang	Columbia University
Ted	Chinburg	University of Pennsylvania
Foivos	Chnaras	University of Maryland
SoYoung	Choi	Gyeongsang National University
Youn-Seo	Choi	KIAS
Mirela	Ciperiani	University of Texas at Austin
Pierre	Colmez	Sorbonne Université, IMJ-PRG
Lilybelle	Cowland Kellock	University College London
Andrzej	Dabrowski	University of Szczecin, Poland
Shamik	Das	Harish-Chandra Research Institute
Luigi	De Filpo	Sapienza, University of Rome
Julio	de Mello Bezerra	Regensburg University

Vincenzo	Di Bartolo	University of Cambridge
Fred	Diamond	King's College London
Xenia	Dimitrakopoulou	University of Warwick
Mladen	Dimitrov	University of Lille
Vladimir	Dokchitser	University College London
Tim	Dokchitser	University of Bristol
Zhenghang	Du	Universität Regensburg
Tom	Fisher	University of Cambridge
Matthias	Flach	California Institute of Technology
Ho Leung	Fong	University of Sheffield
Bence	Forrás	Universität Duisburg-Essen
Olivier	Fouquet	Université de Besançon
Lionel	Fourquaux	University of Rennes
Sam	Frengley	University of Cambridge
Takako	Fukaya	University of Chicago
Takashi	Fukuda	Nihon University (retired)
Kaoru	Fukuda	no affiliation
Rylan	Gajek-Leonard	Union College
Alexandros	Galanakis	Universität Bielefeld
Gautam	Gangopadhyay	Vilnius University
Luis	Garcia	University College London
Jędrzej	Garnek	Institute of Mathematics of the Polish Academy of Sciences
Thomas	Geisser	Rikkyo University
Sohan	Ghosh	Harish Chandra Research Institute
Andrew	Graham	Université Paris-Saclay
Holly	Green	University College London
Ralph	Greenberg	University of Washington, Seattle
Oli	Gregory	Imperial College London
Rafah	Hajjar Munoz	Columbia University
Zeping	Hao	University of Warwick
Takashi	Hara	Tsuda University
Shai	Haran	Technion
Michael	Harris	Columbia University
Guy	Henniart	Université Paris-Saclay
Ming-Lun	Hsieh	National Taiwan University
Ting-Han	Huang	Concordia University
Atsushi	Ichino	Kyoto University
Luc	Illusie	Université Paris-Saclay
Bo-Hae	Im	KAIST, Korea

Hiroshi	Ishimoto	Osaka Metropolitan University
Francesco Maria	Iudica	Universite de Caen Normandie
Anuj	Jakhar	IIT Madras
Yubo	Jin	Durham University
Henri	Johnston	University of Exeter
Hwanyup	Jung	Chungbuk National University
Mahesh	Kakde	Indian Institute of Science, Bangalore
Takenori	Kataoka	Tokyo University of Science
Kazuya	Kato	University of Chicago
Yukako	Kezuka	Sorbonne Université, IMJ-PRG
Chan-Ho	Kim	KIAS
Sören	Kleine	Universität der Bundeswehr München
Heiko	Knospe	TH Köln
Shinichi	Kobayashi	Kyushu University
Alexandros	Konstantinou	University College London
Gene	Kopp	Louisiana State University
Firtina	Kucuk	University College Dublin
Masato	Kurihara	Keio University
Wan	Lee	Ulsan National Institute of Science and Technology
Benjamin	Lemaigre	Humboldt-Universität zu Berlin
Mushunje	Leonard	Columbia University
Yong-Xiong	Li	Tsinghua University
Jianing	Li	Shandong University (Qingdao campus)
Haidong	Li	Morningside Center of Mathematics, AMSS
David	Lilienfeldt	Hebrew University of Jerusalem
David	Loeffler	University of Warwick
Saikat	Maity	Pondicherry University
Muhammad	Manji	University of Warwick
Diego	Marques	Universidade de Brasília
Ahmed	Matar	University of Bahrain
Lewis	Matthews	University of Nottingham
Barry	Mazur	Harvard University
Bill	McCallum	University of Arizona
Fernando	Montans	Universidad de la Republica - Uruguay (retired)
Hassan	Mouadi	Polydisciplinaire Faculty of Taroudant
Katharina	Müller	Universite Laval
Sam	Mundy	Princeton University
Kazuaki	Murakami	Toho University
Hayan	Nam	Duksung Women's University

Meshach	Ndlovu	Gwanda State University
Yusuke	Nemoto	Chiba university
Tam	Nguyen	University of British Columbia
Andreas	Nickel	University of the Bundeswehr Munich
Martí	Oller Riera	University of Cambridge
Kazuto	Ota	Osaka University
Luis Santiago	Palacios	Universidad de Santiago de Chile
Aleksei	Pantchichkine	Institut Fourier, University Grenoble Alpes
Owen	Patashnick	University of Bristol
Maria Rosaria	Pati	Université de Caen Normandie
Bernadette	Perrin-Riou	Université Paris-Saclay
Supriya	Pisolkar	Indian Institute of Science Education and Research
Cristian	Popescu	University of California San Diego
Nandagopal	Ramachandran	University of California San Diego
Celebi	Recep	University of Florida
Robert	Rockwood	King's College London
Giovanni	Rosso	Concordia University
Kenji	Sakugawa	Shinshu University
Takamichi	Sano	Osaka Metropolitan University
Shu	Sasaki	Queen Mary University of London
Jack	Savickas	University of London
Peter	Schneider	University of Münster
Leila	Schneps	Sorbonne Université, IMJ-PRG
Tony	Scholl	University of Cambridge
Jack	Sempliner	Imperial College London
Daniel	Seress	Eötvös Loránd University, Budapest
Romyar	Sharifi	University of California, Los Angeles
Jiahe	Shen	Columbia University
Arshay	Sheth	University of Warwick
Hejing	Shi	Sun Yat-sen University
Pratiksha	Shingavekar	Indian Institute of Technology, Madras
Xia	Shiwei	Shandong University,
David	Solomon	University College London
Florian	Sprung	University of Arizona
Elie	Studnia	Université Paris Cité
Xinxin	Sun	Shandong University
Miyu	Suzuki	Kyoto University
Sohei	Tateno	Nagoya University
Mohamed	Tawfik	King's College London

Richard	Taylor	Stanford University
Jack	Thorne	University of Cambridge
Jacques	Tilouine	Université Sorbonne Paris Nord
Dan	Townsend	Northwestern University
Jun	Ueki	Ochanomizu University
Jeanine	Van Order	Pontifícia Universidade Católica do Rio de Janeiro
Ana Marija	Vego	ETH Zürich
Otmar	Venjakob	Heidelberg University
Guhan	Venkat	Ashoka University
Robin	Visser	University of Warwick
Simon	Wadsley	University of Cambridge
Qixiang	Wang	Université Paris-Saclay
Larry	Washington	University of Maryland
Wojtek	Wawrów	London School of Geometry & Number Theory
Fu-Tsun	Wei	National Tsing Hua University
Ariel	Weiss	Ohio State University
Dmitri	Whitmore	University of Cambridge
Andrew	Wiles	University of Oxford
Chris	Williams	University of Nottingham
Xiaorun	Wu	Columbia University
Chris	Wuthrich	University of Nottingham
Yujie	Xu	Massachusetts Institute of Technology
Ruichen	Xu	Morningside Centre of Mathematics
Shunsuke	Yamana	Osaka Metropolitan University
Yuzheng	Yan	Boston College
Duxing	Yang	Imperial College London
Yuan	Yang	Imperial College London
Yicheng	Yang	LSGNT (University College London)
Jinjoo	Yoo	UNIST
Qiyao	Yu	Columbia University
Myungjun	Yu	Yonsei University
Gergely	Zábrádi	Eötvös Loránd University, Budapest
Sarah	Zerbes	ETH Zürich
Shuai	Zhai	University of Cambridge & Shandong University
Heer	Zhao	University of Duisburg-Essen
Shouwu	Zhang	Princeton University
Xinyao	Zhang	The University of Tokyo
Xiaoyu	Zhang	University of Duisburg-Essen