

# Étale Cohomology

## **The Norm Residue Theorem in Motivic Cohomology** Christian Haesemeyer 2019-06-11

This book presents the complete proof of the Bloch-Kato conjecture and several related conjectures of Beilinson and Lichtenbaum in algebraic geometry. Brought together here for the first time, these conjectures describe the structure of étale cohomology and its relation to motivic cohomology and Chow groups. Although the proof relies on the work of several people, it is credited primarily to Vladimir Voevodsky. The authors draw on a multitude of published and unpublished sources to explain the large-scale structure of Voevodsky's proof and introduce the key figures behind its development. They proceed to describe the highly innovative geometric constructions of Markus Rost, including the construction of norm varieties, which play a crucial role in the proof. The book then addresses symmetric powers of motives and motivic cohomology operations. Comprehensive and self-contained, *The Norm Residue Theorem in Motivic Cohomology* unites various components of the proof that until now were scattered across many sources of varying accessibility, often with differing hypotheses, definitions, and language.

*Berkovich Spaces and Applications* Antoine Ducros 2014-11-21 We present an introduction to Berkovich's theory of non-archimedean analytic spaces that emphasizes its applications in various fields. The first part contains surveys of a foundational nature, including an introduction to Berkovich analytic spaces by M. Temkin, and to étale cohomology by A. Ducros, as well as a short note by C. Favre on the topology of some Berkovich spaces. The second part focuses on applications to geometry. A second text by A. Ducros contains a new proof of the fact that the higher direct images of a coherent sheaf under a proper map are coherent, and B. Rémy, A. Thuillier and A. Werner provide an overview of their work on the compactification of Bruhat-Tits buildings using Berkovich analytic geometry. The third and final part explores the relationship between non-

archimedean geometry and dynamics. A contribution by M. Jonsson contains a thorough discussion of non-archimedean dynamical systems in dimension 1 and 2. Finally a survey by J.-P. Otal gives an account of Morgan-Shalen's theory of compactification of character varieties. This book will provide the reader with enough material on the basic concepts and constructions related to Berkovich spaces to move on to more advanced research articles on the subject. We also hope that the applications presented here will inspire the reader to discover new settings where these beautiful and intricate objects might arise.

**Galois Cohomology** Jean-Pierre Serre 2013-12-01 This is an updated English translation of *Cohomologie Galoisienne*, published more than thirty years ago as one of the very first versions of *Lecture Notes in Mathematics*. It includes a reproduction of an influential paper by R. Steinberg, together with some new material and an expanded bibliography.

## Central Simple Algebras and Galois Cohomology

Philippe Gille 2017-08-10 The first comprehensive, modern introduction to the theory of central simple algebras over arbitrary fields, this book starts from the basics and reaches such advanced results as the Merkurjev-Suslin theorem, a culmination of work initiated by Brauer, Noether, Hasse and Albert, and the starting point of current research in motivic cohomology theory by Voevodsky, Suslin, Rost and others. Assuming only a solid background in algebra, the text covers the basic theory of central simple algebras, methods of Galois descent and Galois cohomology, Severi-Brauer varieties, and techniques in Milnor K-theory and K-cohomology, leading to a full proof of the Merkurjev-Suslin theorem and its application to the characterization of reduced norms. The final chapter rounds off the theory by presenting the results in positive characteristic, including the theorems of Bloch-Gabber-Kato and Izhboldin. This second edition has been carefully revised and updated, and contains important additional topics.

**Cohomology of Arithmetic Groups** James W. Cogdell 2018-08-18 This book discusses the mathematical interests of Joachim Schwermer, who throughout his career has focused on the cohomology of arithmetic groups, automorphic forms and the geometry of arithmetic manifolds. To mark his 66th birthday, the editors brought together mathematical experts to offer an overview of the current state of research in these and related areas. The result is this book, with contributions ranging from topology to arithmetic. It probes the relation between cohomology of arithmetic groups and automorphic forms and their L-functions, and spans the range from classical Bianchi groups to the theory of Shimura varieties. It is a valuable reference for both experts in the fields and for graduate students and postdocs wanting to discover where the current frontiers lie.

**Introduction to Algebraic Geometry** Steven Dale Cutkosky 2018-06-01 This book presents a readable and accessible introductory course in algebraic geometry, with most of the fundamental classical results presented with complete proofs. An emphasis is placed on developing connections between geometric and algebraic aspects of the theory. Differences between the theory in characteristic and positive characteristic are emphasized. The basic tools of classical and modern algebraic geometry are introduced, including varieties, schemes, singularities, sheaves, sheaf cohomology, and intersection theory. Basic classical results on curves and surfaces are proved. More advanced topics such as ramification theory, Zariski's main theorem, and Bertini's theorems for general linear systems are presented, with proofs, in the final chapters. With more than 200 exercises, the book is an excellent resource for teaching and learning introductory algebraic geometry.

**Étale Cohomology (PMS-33), Volume 33** James S. Milne 2016-10-11 One of the most important mathematical achievements of the past several decades has been A. Grothendieck's work on algebraic geometry. In the early 1960s, he and M. Artin introduced étale cohomology in order to extend the methods of sheaf-theoretic cohomology from complex varieties to more general schemes. This work found many applications, not only in algebraic geometry, but also in several different branches of number

theory and in the representation theory of finite and p-adic groups. Yet until now, the work has been available only in the original massive and difficult papers. In order to provide an accessible introduction to étale cohomology, J. S. Milne offers this more elementary account covering the essential features of the theory. The author begins with a review of the basic properties of flat and étale morphisms and of the algebraic fundamental group. The next two chapters concern the basic theory of étale sheaves and elementary étale cohomology, and are followed by an application of the cohomology to the study of the Brauer group. After a detailed analysis of the cohomology of curves and surfaces, Professor Milne proves the fundamental theorems in étale cohomology -- those of base change, purity, Poincaré duality, and the Lefschetz trace formula. He then applies these theorems to show the rationality of some very general L-series. Originally published in 1980. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.

*The Brauer-Grothendieck Group* Jean-Louis Colliot-Thélène 2021-07-30 This monograph provides a systematic treatment of the Brauer group of schemes, from the foundational work of Grothendieck to recent applications in arithmetic and algebraic geometry. The importance of the cohomological Brauer group for applications to Diophantine equations and algebraic geometry was discovered soon after this group was introduced by Grothendieck. The Brauer-Manin obstruction plays a crucial role in the study of rational points on varieties over global fields. The birational invariance of the Brauer group was recently used in a novel way to establish the irrationality of many new classes of algebraic varieties. The book covers the vast theory underpinning these and other applications. Intended as an introduction to

cohomological methods in algebraic geometry, most of the book is accessible to readers with a knowledge of algebra, algebraic geometry and algebraic number theory at graduate level. Much of the more advanced material is not readily available in book form elsewhere; notably, de Jong's proof of Gabber's theorem, the specialisation method and applications of the Brauer group to rationality questions, an in-depth study of the Brauer-Manin obstruction, and proof of the finiteness theorem for the Brauer group of abelian varieties and K3 surfaces over finitely generated fields. The book surveys recent work but also gives detailed proofs of basic theorems, maintaining a balance between general theory and concrete examples. Over half a century after Grothendieck's foundational seminars on the topic, The Brauer-Grothendieck Group is a treatise that fills a longstanding gap in the literature, providing researchers, including research students, with a valuable reference on a central object of algebraic and arithmetic geometry.

**Étale Cohomology** J. S. Milne 1980

Étale Homotopy Michael Artin 2006-11-14

Generalized Étale Cohomology Theories John

Jardine 2010-12-15 A generalized étale

cohomology theory is a theory which is

represented by a presheaf of spectra on an étale site for an algebraic variety, in analogy with the way an ordinary spectrum represents a cohomology theory for spaces. Examples include étale cohomology and étale K-theory. This book gives new and complete proofs of both Thomason's descent theorem for Bott periodic K-theory and the Nisnevich descent theorem. In doing so, it exposes most of the major ideas of the homotopy theory of presheaves of spectra, and generalized étale homology theories in particular. The treatment includes, for the purpose of adequately dealing with cup product structures, a development of stable homotopy theory for  $n$ -fold spectra, which is then promoted to the level of presheaves of  $n$ -fold spectra. This book should be of interest to all researchers working in fields related to algebraic K-theory. The techniques presented here are essentially combinatorial, and hence algebraic. An extensive background in traditional stable homotopy theory is not assumed. ----- Reviews (...) in developing the techniques of the subject,

introduces the reader to the stable homotopy category of simplicial presheaves. (...) This book provides the user with the first complete account which is sensitive enough to be compatible with the sort of closed model category necessary in K-theory applications (...). As an application of the techniques the author gives proofs of the descent theorems of R. W. Thomason and Y. A. Nisnevich. (...) The book concludes with a discussion of the Lichtenbaum-Quillen conjecture (an approximation to Thomason's theorem without Bott periodicity). The recent proof of this conjecture, by V. Voevodsky, (...) makes this volume compulsory reading for all who want to be au fait with current trends in algebraic K-theory! - Zentralblatt MATH The presentation of these topics is highly original. The book will be very useful for any researcher interested in subjects related to algebraic K-theory. - Matematica

**Étale Cohomology of Rigid Analytic**

**Varieties and Adic Spaces** Roland Huber

2013-07-01 Diese Forschungsmonographie von

hohem mathematischen Niveau liefert einen

neuen Zugang zu den rigid-analytischen

Räumen, sowie ihrer étalen Kohomologie. USP:

Aus der Forschung: Zahlentheorie und

Algebraische Geometrie

*Étale cohomology for non-Archimedean analytic*

*spaces* Vladimir G. Berkovich 1993

**Rings, Hopf Algebras, and Brauer Groups**

Stefaan Caenepeel 2020-09-30 "Based on papers

presented at a recent international conference

on algebra and algebraic geometry held jointly

in Antwerp and Brussels, Belgium. Presents both

survey and research articles featuring new

results from the intersection of algebra and

geometry. "

*Lecture Notes on Motivic Cohomology* Carlo

Mazza 2006 The notion of a motive is an elusive

one, like its namesake "the motif" of Cezanne's

impressionist method of painting. Its existence

was first suggested by Grothendieck in 1964 as

the underlying structure behind the myriad

cohomology theories in Algebraic Geometry. We

now know that there is a triangulated theory of

motives, discovered by Vladimir Voevodsky,

which suffices for the development of a

satisfactory Motivic Cohomology theory.

However, the existence of motives themselves

remains conjectural. This book provides an

account of the triangulated theory of motives. Its purpose is to introduce Motivic Cohomology, to develop its main properties, and finally to relate it to other known invariants of algebraic varieties and rings such as Milnor K-theory, etale cohomology, and Chow groups. The book is divided into lectures, grouped in six parts. The first part presents the definition of Motivic Cohomology, based upon the notion of presheaves with transfers. Some elementary comparison theorems are given in this part. The theory of (etale, Nisnevich, and Zariski) sheaves with transfers is developed in parts two, three, and six, respectively. The theoretical core of the book is the fourth part, presenting the triangulated category of motives. Finally, the comparison with higher Chow groups is developed in part five. The lecture notes format is designed for the book to be read by an advanced graduate student or an expert in a related field. The lectures roughly correspond to one-hour lectures given by Voevodsky during the course he gave at the Institute for Advanced Study in Princeton on this subject in 1999-2000. In addition, many of the original proofs have been simplified and improved so that this book will also be a useful tool for research mathematicians. Information for our distributors: Titles in this series are copublished with the Clay Mathematics Institute (Cambridge, MA).

*Group Cohomology and Algebraic Cycles* Burt Totaro 2014-06-26 Group cohomology reveals a deep relationship between algebra and topology, and its recent applications have provided important insights into the Hodge conjecture and algebraic geometry more broadly. This book presents a coherent suite of computational tools for the study of group cohomology and algebraic cycles. Early chapters synthesize background material from topology, algebraic geometry, and commutative algebra so readers do not have to form connections between the literatures on their own. Later chapters demonstrate Peter Symonds's influential proof of David Benson's regularity conjecture, offering several new variants and improvements. Complete with concrete examples and computations throughout, and a list of open problems for further study, this book will be valuable to graduate students and researchers in algebraic

geometry and related fields.

**Arithmetic Duality Theorems** J. S. Milne 1986

Here, published for the first time, are the complete proofs of the fundamental arithmetic duality theorems that have come to play an increasingly important role in number theory and arithmetic geometry. The text covers these theorems in Galois cohomology, etale cohomology, and flat cohomology and addresses applications in the above areas. The writing is expository and the book will serve as an invaluable reference text as well as an excellent introduction to the subject.

**Etale Cohomology Theory (Revised Edition)**

Lei Fu 2015-02-27 Etale cohomology is an important branch in arithmetic geometry. This book covers the main materials in SGA 1, SGA 4, SGA 4 1/2 and SGA 5 on etale cohomology theory, which includes decent theory, etale fundamental groups, Galois cohomology, etale cohomology, derived categories, base change theorems, duality, and  $\mathbb{Q}$ -adic cohomology. The prerequisites for reading this book are basic algebraic geometry and advanced commutative algebra.

**Etale Cohomology and the Weil Conjecture**

Eberhard Freitag 1987-12-29 This book is concerned with one of the most important developments in algebraic geometry during the last decades. In 1949 AndrA(c) Weil formulated his famous conjectures about the numbers of solutions of diophantine equations in finite fields. He himself proved his conjectures by means of an algebraic theory of Abelian varieties in the one-variable case. In 1960 appeared the first chapter of the "EIA(c)ments de GA(c)ometrie AlgA(c)braique" par A. Grothendieck (en collaboration avec J. DieudonnA(c)). In these "EIA(c)ments" Grothendieck evolved a new foundation of algebraic geometry with the declared aim to come to a proof of the Weil conjectures by means of a new algebraic cohomology theory. Deligne succeeded in proving the Weil conjectures on the basis of Grothendiecks ideas. The aim of this "Ergebnisbericht" is to develop as self-contained as possible and as short as possible Grothendiecks 1-adic cohomology theory including Delignes monodromy theory and to present his original proof of the Weil conjectures.

*Algebraic Geometry* Ulrich Görtz 2010-08-09

This book introduces the reader to modern algebraic geometry. It presents Grothendieck's technically demanding language of schemes that is the basis of the most important developments in the last fifty years within this area. A systematic treatment and motivation of the theory is emphasized, using concrete examples to illustrate its usefulness. Several examples from the realm of Hilbert modular surfaces and of determinantal varieties are used methodically to discuss the covered techniques. Thus the reader experiences that the further development of the theory yields an ever better understanding of these fascinating objects. The text is complemented by many exercises that serve to check the comprehension of the text, treat further examples, or give an outlook on further results. The volume at hand is an introduction to schemes. To get started, it requires only basic knowledge in abstract algebra and topology. Essential facts from commutative algebra are assembled in an appendix. It will be complemented by a second volume on the cohomology of schemes.

**Introduction to Étale Cohomology** Günter Tamme 2012-12-06 A succinct introduction to étale cohomology. Well-presented and chosen this will be a most welcome addition to the algebraic geometer's library.

*Local Fields* Jean-Pierre Serre 2013-06-29 The goal of this book is to present local class field theory from the cohomological point of view, following the method inaugurated by Hochschild and developed by Artin-Tate. This theory is about extensions—primarily abelian—of "local" (i.e., complete for a discrete valuation) fields with finite residue field. For example, such fields are obtained by completing an algebraic number field; that is one of the aspects of "localisation". The chapters are grouped in "parts". There are three preliminary parts: the first two on the general theory of local fields, the third on group cohomology. Local class field theory, strictly speaking, does not appear until the fourth part. Here is a more precise outline of the contents of these four parts: The first contains basic definitions and results on discrete valuation rings, Dedekind domains (which are their "globalisation") and the completion process. The prerequisite for this part is a knowledge of

elementary notions of algebra and topology, which may be found for instance in Bourbaki. The second part is concerned with ramification phenomena (different, discriminant, ramification groups, Artin representation). Just as in the first part, no assumptions are made here about the residue fields. It is in this setting that the "norm" map is studied; I have expressed the results in terms of "additive polynomials" and of "multiplicative polynomials", since using the language of algebraic geometry would have led me too far astray.

*Étale Homotopy of Simplicial Schemes.*

(AM-104), Volume 104 Eric M. Friedlander 2016-03-02 This book presents a coherent account of the current status of étale homotopy theory, a topological theory introduced into abstract algebraic geometry by M. Artin and B. Mazur. Eric M. Friedlander presents many of his own applications of this theory to algebraic topology, finite Chevalley groups, and algebraic geometry. Of particular interest are the discussions concerning the Adams Conjecture, K-theories of finite fields, and Poincaré duality. Because these applications have required repeated modifications of the original formulation of étale homotopy theory, the author provides a new treatment of the foundations which is more general and more precise than previous versions. One purpose of this book is to offer the basic techniques and results of étale homotopy theory to topologists and algebraic geometers who may then apply the theory in their own work. With a view to such future applications, the author has introduced a number of new constructions (function complexes, relative homology and cohomology, generalized cohomology) which have immediately proved applicable to algebraic K-theory.

**Generalized Étale Cohomology Theories** John F. Jardine 2010-12-09 A generalized étale cohomology theory is a theory which is represented by a presheaf of spectra on an étale site for an algebraic variety, in analogy with the way an ordinary spectrum represents a cohomology theory for spaces. Examples include étale cohomology and étale K-theory. This book gives new and complete proofs of both Thomason's descent theorem for Bott periodic K-theory and the Nisnevich descent theorem. In



doing so, it exposes most of the major ideas of the homotopy theory of presheaves of spectra, and generalized étale homology theories in particular. The treatment includes, for the purpose of adequately dealing with cup product structures, a development of stable homotopy theory for  $n$ -fold spectra, which is then promoted to the level of presheaves of  $n$ -fold spectra. This book should be of interest to all researchers working in fields related to algebraic K-theory. The techniques presented here are essentially combinatorial, and hence algebraic. An extensive background in traditional stable homotopy theory is not assumed. ----- Reviews (...) in developing the techniques of the subject, introduces the reader to the stable homotopy category of simplicial presheaves. (...) This book provides the user with the first complete account which is sensitive enough to be compatible with the sort of closed model category necessary in K-theory applications (...). As an application of the techniques the author gives proofs of the descent theorems of R. W. Thomason and Y. A. Nisnevich. (...) The book concludes with a discussion of the Lichtenbaum-Quillen conjecture (an approximation to Thomason's theorem without Bott periodicity). The recent proof of this conjecture, by V. Voevodsky, (...) makes this volume compulsory reading for all who want to be au fait with current trends in algebraic K-theory! - Zentralblatt MATH The presentation of these topics is highly original. The book will be very useful for any researcher interested in subjects related to algebraic K-theory. - Matematica

*Étale Cohomology (PMS-33)* J. S. Milne  
1980-04-21 One of the most important mathematical achievements of the past several decades has been A. Grothendieck's work on algebraic geometry. In the early 1960s, he and M. Artin introduced étale cohomology in order to extend the methods of sheaf-theoretic cohomology from complex varieties to more general schemes. This work found many applications, not only in algebraic geometry, but also in several different branches of number theory and in the representation theory of finite and  $p$ -adic groups. Yet until now, the work has been available only in the original massive and difficult papers. In order to provide an accessible introduction to étale cohomology, J. S. Milne

offers this more elementary account covering the essential features of the theory. The author begins with a review of the basic properties of flat and étale morphisms and of the algebraic fundamental group. The next two chapters concern the basic theory of étale sheaves and elementary étale cohomology, and are followed by an application of the cohomology to the study of the Brauer group. After a detailed analysis of the cohomology of curves and surfaces, Professor Milne proves the fundamental theorems in étale cohomology -- those of base change, purity, Poincaré duality, and the Lefschetz trace formula. He then applies these theorems to show the rationality of some very general L-series. Originally published in 1980. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.

Introduction to Étale Cohomology Gunter Tamme 1994-09-28

**Real and Étale Cohomology** Claus Scheiderer 1994 This book makes a systematic study of the relations between the  $A(c)$ étale cohomology of a scheme and the orderings of its residue fields. A major result is that in high degrees,  $A(c)$ étale cohomology is cohomology of the real spectrum. It also contains new contributions in group cohomology and in topos theory. It is of interest to graduate students and researchers who work in algebraic geometry (not only real) and have some familiarity with the basics of  $A(c)$ étale cohomology and Grothendieck sites. Independently, it is of interest to people working in the cohomology theory of groups or in topos theory.

Étale Cohomology of Rigid Analytic Spaces A. J. Jong 1995

**Étale Cohomology and the Weil Conjecture** Eberhard Freitag 2013-03-14 Some years ago a conference on  $l$ -adic cohomology in Oberwolfach was held with the aim of reaching an

understanding of Deligne's proof of the Weil conjectures. For the convenience of the speakers the present authors - who were also the organisers of that meeting - prepared short notes containing the central definitions and ideas of the proofs. The unexpected interest for these notes and the various suggestions to publish them encouraged us to work somewhat more on them and fill out the gaps. Our aim was to develop the theory in as self contained and as short a manner as possible. We intended especially to provide a complete introduction to etale and  $l$ -adic cohomology theory including the monodromy theory of Lefschetz pencils. Of course, all the central ideas are due to the people who created the theory, especially Grothendieck and Deligne. The main references are the SGA-notes [64-69]. With the kind permission of Professor J. A. Dieudonne we have included in the book that finally resulted his excellent notes on the history of the Weil conjectures, as a second introduction. Our original notes were written in German. However, we finally followed the recommendation made variously to publish the book in English. We had the good fortune that Professor W. Waterhouse and his wife Betty agreed to translate our manuscript. We want to thank them very warmly for their willing involvement in such a tedious task. We are very grateful to the staff of Springer-Verlag for their careful work.

**Etale Cohomology Theory** Lei Fu 2011 Etale cohomology is an important branch in arithmetic geometry. This book covers the main materials in SGA 1, SGA 4, SGA 4 1/2 and SGA 5 on etale cohomology theory, which includes decent theory, etale fundamental groups, Galois cohomology, etale cohomology, derived categories, base change theorems, duality, and  $l$ -adic cohomology. The prerequisites for reading this book are basic algebraic geometry and advanced commutative algebra.

**Weil's Conjecture for Function Fields** Dennis Gaitsgory 2019-02-19 A central concern of number theory is the study of local-to-global principles, which describe the behavior of a global field  $K$  in terms of the behavior of various completions of  $K$ . This book looks at a specific example of a local-to-global principle: Weil's conjecture on the Tamagawa number of a semisimple algebraic group  $G$  over  $K$ . In the case

where  $K$  is the function field of an algebraic curve  $X$ , this conjecture counts the number of  $G$ -bundles on  $X$  (global information) in terms of the reduction of  $G$  at the points of  $X$  (local information). The goal of this book is to give a conceptual proof of Weil's conjecture, based on the geometry of the moduli stack of  $G$ -bundles. Inspired by ideas from algebraic topology, it introduces a theory of factorization homology in the setting  $l$ -adic sheaves. Using this theory, Dennis Gaitsgory and Jacob Lurie articulate a different local-to-global principle: a product formula that expresses the cohomology of the moduli stack of  $G$ -bundles (a global object) as a tensor product of local factors. Using a version of the Grothendieck-Lefschetz trace formula, Gaitsgory and Lurie show that this product formula implies Weil's conjecture. The proof of the product formula will appear in a sequel volume.

**Cohomological Invariants in Galois Cohomology** Skip Garibaldi 2003 This volume is concerned with algebraic invariants, such as the Stiefel-Whitney classes of quadratic forms (with values in Galois cohomology mod 2) and the trace form of etale algebras (with values in the Witt ring). The invariants are analogues for Galois cohomology of the characteristic classes of topology. Historically, one of the first examples of cohomological invariants of the type considered here was the Hasse-Witt invariant of quadratic forms. The first part classifies such invariants in several cases. A principal tool is the notion of versal torsor, which is an analogue of the universal bundle in topology. The second part gives Rost's determination of the invariants of  $G$ -torsors with values in  $H^3(\mathbb{Q}/\mathbb{Z}(2))$ , when  $G$  is a semisimple, simply connected, linear group. This part gives detailed proofs of the existence and basic properties of the Rost invariant. This is the first time that most of this material appears in print.

**Arithmetic of Higher-Dimensional Algebraic Varieties** Bjorn Poonen 2012-12-06 This text offers a collection of survey and research papers by leading specialists in the field documenting the current understanding of higher dimensional varieties. Recently, it has become clear that ideas from many branches of mathematics can be successfully employed in the study of rational

and integral points. This book will be very valuable for researchers from these various fields who have an interest in arithmetic applications, specialists in arithmetic geometry itself, and graduate students wishing to pursue research in this area.

Weil Conjectures, Perverse Sheaves and l-adic Fourier Transform Reinhardt Kiehl 2013-03-14 The authors describe the important generalization of the original Weil conjectures, as given by P. Deligne in his fundamental paper "La conjecture de Weil II". The authors follow the important and beautiful methods of Laumon and Brylinski which lead to a simplification of Deligne's theory. Deligne's work is closely related to the sheaf theoretic theory of perverse sheaves. In this framework Deligne's results on global weights and his notion of purity of complexes obtain a satisfactory and final form. Therefore the authors include the complete theory of middle perverse sheaves. In this part, the l-adic Fourier transform is introduced as a technique providing natural and simple proofs. To round things off, there are three chapters with significant applications of these theories.

An Introduction to Galois Cohomology and its Applications Grégory Berhuy 2010-09-09 This is the first detailed elementary introduction to Galois cohomology and its applications. The introductory section is self-contained and provides the basic results of the theory. Assuming only a minimal background in algebra, the main purpose of this book is to prepare graduate students and researchers for more advanced study.

**Real and Étale Cohomology** Claus Scheiderer 2006-11-15 This book makes a systematic study of the relations between the étale cohomology of a scheme and the orderings of its residue fields. A major result is that in high degrees, étale cohomology is cohomology of the real spectrum. It also contains new contributions in group cohomology and in topos theory. It is of interest to graduate students and researchers who work in algebraic geometry (not only real) and have some familiarity with the basics of étale cohomology and Grothendieck sites. Independently, it is of interest to people working in the cohomology theory of groups or in topos theory.

Group Cohomology and Algebraic Cycles Burt

Totaro 2014-06-26 This book presents a coherent suite of computational tools for the study of group cohomology algebraic cycles.

**Rational Points on Varieties** Bjorn Poonen 2023-08-10 This book is motivated by the problem of determining the set of rational points on a variety, but its true goal is to equip readers with a broad range of tools essential for current research in algebraic geometry and number theory. The book is unconventional in that it provides concise accounts of many topics instead of a comprehensive account of just one—this is intentionally designed to bring readers up to speed rapidly. Among the topics included are Brauer groups, faithfully flat descent, algebraic groups, torsors, étale and fppf cohomology, the Weil conjectures, and the Brauer-Manin and descent obstructions. A final chapter applies all these to study the arithmetic of surfaces. The down-to-earth explanations and the over 100 exercises make the book suitable for use as a graduate-level textbook, but even experts will appreciate having a single source covering many aspects of geometry over an unrestricted ground field and containing some material that cannot be found elsewhere. The origins of arithmetic (or Diophantine) geometry can be traced back to antiquity, and it remains a lively and wide research domain up to our days. The book by Bjorn Poonen, a leading expert in the field, opens doors to this vast field for many readers with different experiences and backgrounds. It leads through various algebraic geometric constructions towards its central subject: obstructions to existence of rational points.

—Yuri Manin, Max-Planck-Institute, Bonn It is clear that my mathematical life would have been very different if a book like this had been around at the time I was a student. —Hendrik Lenstra, University Leiden Understanding rational points on arbitrary algebraic varieties is the ultimate challenge. We have conjectures but few results. Poonen's book, with its mixture of basic constructions and openings into current research, will attract new generations to the Queen of Mathematics. —Jean-Louis Colliot-Thélène, Université Paris-Sud A beautiful subject, handled by a master. —Joseph Silverman, Brown University

Galois Groups and Fundamental Groups Tamás Szamuely 2009-07-16 Ever since the concepts of



Galois groups in algebra and fundamental groups in topology emerged during the nineteenth century, mathematicians have known of the strong analogies between the two concepts. This book presents the connection starting at an elementary level, showing how the judicious use of algebraic geometry gives access to the powerful interplay between algebra and topology that underpins much modern research in geometry and number theory. Assuming as little technical background as possible, the book starts with basic algebraic and topological concepts, but already presented from the modern viewpoint advocated by Grothendieck. This enables a systematic yet accessible development of the theories of fundamental groups of algebraic curves, fundamental groups of schemes, and Tannakian fundamental groups. The connection between fundamental groups and linear differential equations is also developed at increasing levels of generality. Key applications and recent results, for example on the inverse Galois problem, are given throughout.

### **Rigid Analytic Geometry and Its**

**Applications** Jean Fresnel 2012-12-06 Rigid (analytic) spaces were invented to describe degenerations, reductions, and moduli of algebraic curves and abelian varieties. This work, a revised and greatly expanded new English edition of an earlier French text by the same authors, presents important new developments and applications of the theory of rigid analytic spaces to abelian varieties, "points of rigid spaces," étale cohomology, Drinfeld modular curves, and Monsky-Washnitzer cohomology. The exposition is concise, self-contained, rich in examples and exercises, and will serve as an excellent graduate-level text for the classroom or for self-study.

## **Etale Cohomology**

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