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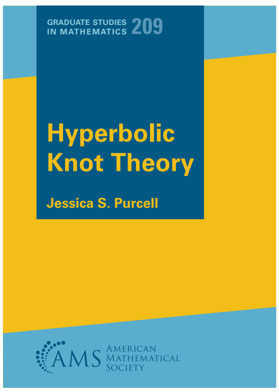


Graduate Studies in Mathematics, Volume 209 (GSM/209)

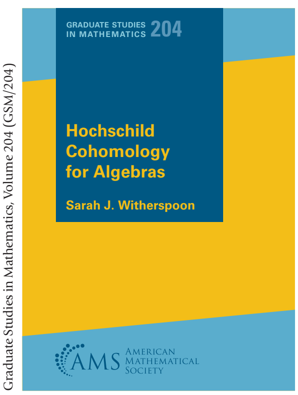
Hyperbolic Knot Theory
by Jessica S. Purcell

Whether for teaching or studying, it is nice when a topic comes with a wealth of concrete examples upon which to illustrate the ideas and tools. In the case of hyperbolic geometry of 3-manifolds, knot complements in the 3-sphere play this role. There is, however, another direction to the relationship. Knot theory has a longer history than 3-dimensional hyperbolic geometry, dating back to Tait's work in the 1870s, and continues to be a widely studied and researched topic in its own right. Work of Riley and Thurston in the 1970s and work of Mostow-Prasad and Gordon-Luecke in the 1980s established that the hyperbolic structure of a knot complement is a knot invariant, thus showing that hyperbolic geometry is one of several essential tools to study knots.

Purcell deftly adopts both perspectives: knot theory as a source of illustrative examples and as a featured topic. She starts by exhibiting the complement of the figure-8 knot in the three-sphere as the gluing of two ideal tetrahedra, setting up the tools to identify its hyperbolic structure, and compute its volume. The rest of Part 1 contains a short introduction to the tools of hyperbolic geometry in dimensions 2 and 3, presenting hyperbolic manifolds using triangulations and the gluing construction, and as quotients of hyperbolic space by the action of a discrete isometry group. Part 1 also includes a discussion of complete hyperbolic structures and hyperbolic Dehn fillings. Part 2 deals with the hyperbolic geometry of special families of knots such as twist knots, 2-bridge knots, and alternating knots where tools are abundant and edifying. Part 3 focuses on knot invariants coming from hyperbolic geometry which have been important in building the still growing "census" of 3-manifolds and their properties.

The prerequisites for this book are a basic background in fundamental groups and covering spaces and some experience with differential topology and Riemannian geometry. With many exercises, illustrations, and useful references, the book is designed for an interactive course, but could also be used for self-study or as a reference that brings its readers quickly up to speed on a wide range of current research topics in low-dimensional hyperbolic geometry.

The AMS Bookshelf is prepared bimonthly by AMS Book Acquisitions Consultant Eriko Hironaka. Her email address is `ehironaka@amsbooks.org`.



Graduate Studies in Mathematics, Volume 204 (GSM/204)

Hochschild Cohomology for Algebras
by Sarah J. Witherspoon

Hochschild cohomology was developed alongside group cohomology in the 1940s as a natural extension of Poincaré's topological homology and cohomology theories from the end of the 19th century. Both are important tools in algebraic topology and representation theory, and continue to be active areas of research, but compared with group theory, there are fewer textbooks on Hochschild cohomology. Part of the reason may be that it has become a broad subject with many branches coming from different applications, including algebraic geometry, category theory, and K-theory.

In this book, Witherspoon presents Hochschild cohomology with a focus on its uses in studying algebras and representation theory. She introduces Hochschild cohomology both in its original form and as a Gerstenhaber algebra, with an associative product and a nonassociative Lie bracket. She then explores examples coming from different kinds of settings such as smooth commutative algebras, Koszul algebras, and quivers, and presents the Hochschild-Kostant-Rosenberg Theorem. The heart of the book is devoted to topics like algebraic deformation theory, properties of the Gerstenhaber bracket, infinity algebras, and support varieties for finite-dimensional algebras and Hopf algebras.

The book is intended for advanced graduate students with a strong background in algebra. There are many exercises and a helpful appendix giving a quick refresher on the basics of homological algebra. The book will also be useful as a reference for algebraists interested in using tools from cohomology theory.