Emergent Research:
The PIMS Postdoctoral Fellow Seminar

Apr 19, 2023 | 9:30am Pacific

Pacific Institute *for the* Mathematical Sciences

Quaternion algebras for surgeries on knots

ABSTRACT:
Work of Thurston and Perelman implies that every compact 3-manifold decomposes into pieces each of which supports one of eight possible geometric structures. Among these eight geometries, the hyperbolic geometry leads to the richest and least well understood class of manifolds. Moreover, Mostow-Prasad rigidity implies that any such hyperbolic structure is unique in stark contrast to the situation in dimension 2. This rigidity also gives rise to number-theoretic invariants of hyperbolic 3-manifolds, and my talk will focus on these. In particular, associated to any finite volume hyperbolic 3-manifold is a number field called the trace field and a quaternion algebra over that trace field. For knot complements, this quaternion algebra is trivial in the sense that it is always a matrix algebra. However, for closed orbifolds such as those obtained by hyperbolic Dehn surgery on a hyperbolic knot complement, the algebra is often nontrivial. A conjecture of Chinburg, Reid, and Stover relates the algebras one can obtain by surgery to the Alexander polynomial of the knot. This problem involves the character variety of the knot and a generalization of quaternion algebras called Azumaya algebras. I will discuss the interplay of these objects as well as some work on the conjecture.

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SPEAKER BIO:
Nicholas Rouse obtained his Ph.D. at Rice University in 2022 under the supervision of Alan Reid. He is currently a PIMS postdoctoral fellow at the University of British Columbia working with Ben Williams and Liam Watson. His research focuses on applying number theory and algebraic geometry to problems in 3-dimensional topology.

For more information and registration:
https://www.pims.math.ca/seminars/PIMSPDF

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