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Major research interests: **Mathematical ramifications of developments in mathematical physics; in particular, ramifications of developments in quantum field theory in the fields of topology, algebra and combinatorics**

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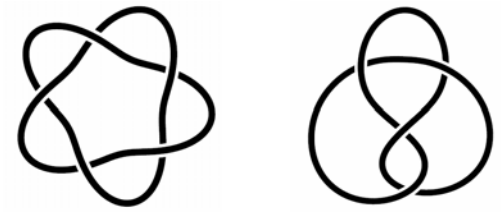
Mathematical Physics impacting Pure Mathematics.

One of the most significant currents in contemporary mathematics is the exploration and creation of the new mathematics associated with recent developments in high energy physics (such things as quantum field theories, quantum gravity and string theory). This, of course, is only the revitalization of a dialogue between physics and mathematics which has existed as long as these subjects have been studied.

My area of specialization within this broad current is in what is often called *Quantum Topology*.

Here is a simple manifestation:



Constructions arising from Quantum Field Theory can prove that these knots cannot be deformed, without breaking a strand, into each other. There are much simpler ways to do this, but these constructions have given us a window into a universe of much deeper relationships between Quantum Field Theory (which was developed to model the interactions of elementary particles) and Topology (which studies the possible shapes of space).

Some current directions

My recent focus has been on topological invariants of knots and three-manifolds associated to quantum field theories and the question of how these apparently powerful constructions actually represent topological information about these objects.

- The search for a combinatorial theory of surgery presentations of covering spaces of knots and three-manifolds.
- The search for a theory of how quantum invariants of knots and three-manifolds encode information about these object's 4-dimensional properties (e.g. information about the knot cobordism group).
- The development of a purely combinatorial version of Alexeev and Meinrenken's "Non-commutative Chern-Weil theory" and its wider implications.

Selected Publications

S. Garoufalidis and A. Kricker. Finite Type Invariants of Cyclic Branched Covers, Topology, 43, 1247-1283 (2004).

A. Kricker. A Surgery Formula for the 2-loop piece of the LMO invariant of a Pair, Geom. Top. Monogr. 5, 161-181 (2002).

S. Garoufalidis and A. Kricker. A rational non-commutative invariant of boundary links, Geom. Topol. 8, 115-204 (2004).

S. Garoufalidis and A. Kricker. A Surgery view of Boundary Links, Math. Annalen 327, 103-115 (2003).