Knot Theory and its Ramification

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ORGANIZER: Józef H. Przytycki (*George Washington University)*

Friday, July 6, 10:45–12:45, Medium Hall A

TALKS:

Seiichi Kamada (*Hiroshima University, JP*), COAUTHORS: J. Scott Carter, **Graphical description of branched coverings and 2-dimensional braids**

Józef H. Przytycki (*George Washington University, USA*), **Distributivity versus associativity in the homology theory of algebraic structures**

Krzysztof Putyra (*Columbia University, USA*), **Odd Khovanov homology for tangles**

Joanna Kania-Bartoszyńska (*National Science Fundation, USA*), **Quantum invariants of 3-manifolds and their asymptotics**

Graphical description of branched coverings and 2-dimensional braids

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We discuss about a method of describing simple branched coverings of the 2-sphere by using graphics, called a permutation chart. It is an unoriented version of a chart description of 2-dimensional braids. It helps us to construct the branched covering space from a given monodromy, and to understand the classification theorem of simple branched coverings of the 2-sphere. Although the idea can be generalized into 3 and 4-dimensions, or higher, such a generalization would be discussed elsewhere. This is a joint work with J. Scott Carter.

Coauthors: J. Scott Carter

Distributivity versus associativity in the homology theory of algebraic structures

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While homology theory of associative structures, such as groups and rings, has been extensively studied in the past beginning with the work of Hopf, Eilenberg, and Hochschild, homology of non-associative distributive structures, such as quandles, were neglected until recently. Distributive structures have been studied for a long time. In 1880, C.S. Peirce emphasized the importance of (right) self-distributivity in algebraic structures. However, homology for these universal algebras was introduced only sixteen years ago by Fenn, Rourke, and Sanderson. We develop this theory in the historical context and propose a general framework to study homology of distributive structures. We illustrate the theory by computing some examples of 1-term homology (in particular showing nontrivial torsion part), and then discussing 4-term homology for Boolean algebras. We outline potential relations to Khovanov homology of links, via the Yang-Baxter operator.

Odd Khovanov homology for tangles

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In 1999 M. Khovanov constructed a bigraded homology from a diagram of a link which is invariant under Reidemeister moves. Then in 2002 he extended this construction for tangles: to $2n$ points on a line he associated an algebra H_n and to a tangle T with $2n$ inputs and $2m$ outputs a dg-bimodule $C(T)$, so that composition of tangles correspond to tensor products of bimodules.

In 2007 P. Ozsvath, J. Rasmussen and Z. Szabo described a variant of Khovanov's construction based on a skew-symmetric algebra and called it 'odd Khovanov homology'. Recently, together with A.Shumakovitch we found the odd analogue of H_n rings and dg-bimodules $C(T)$.

In my talk I will describe both even and odd construction, focusing on differences between them. Then I will construct the odd version of H_n rings and dg-bimodules associated to tangles.

Quantum invariants of 3-manifolds and their asymptotics

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We will discuss some quantum invariants of 3-dimensional manifolds, their asymptotic behavior and connections to other topological invariants.