Sucharit Sarkar

CONTACT

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INTERESTS

Low dimensional topology.

EDUCATION

Ph.D. in Mathematics, Princeton University 2005 – 2009
Bachelor of Mathematics, Indian Statistical Institute 2002 – 2005

POSITIONS

Clay Research Fellow, Clay Mathematics Institute 2009 – present
Ritt Assistant Professor, Columbia Univeristy 2009 – present

RESEARCH

Sucharit Sarkar. *A construction of knot Floer homotopy.* arXiv:0901.2156v1

Matt Hedden, András Juhász and Sucharit Sarkar. *Distinguishing Seifert surfaces using Floer homology.* arXiv:0811.0178v1

Sucharit Sarkar. *Maslov index of holomorphic triangles.* arXiv:math/0609673v2

Sucharit Sarkar and Jiajun Wang. *An algorithm for computing some Heegaard Floer homologies.* Annals of Mathematics, to appear.

Ciprian Manolescu, Peter Ozsváth and Sucharit Sarkar. *A combinatorial description of knot Floer homology.* Annals of Mathematics 169 (2009) 633 – 660

Sucharit Sarkar. *Commutators and squares in free groups.* Algebraic and Geometric Topology 4 (2004) 595 – 602

AWARDS

Honorific fellowship, Princeton University 2008 – 2009
Centennial fellowship, Princeton University 2005 – 2009
Gold Medal for graduating top of undergraduate class. 2005
KVPY scholarship, Govt. of India 2002 – 2005
Silver medal, International Mathematical Olympiad, UK. 2002
Gold medal, International Mathematical Olympiad, USA. 2001

TEACHING

Trainer for Putnam. (Fall 2008)
Teacher for calculus. *MAT 103* (Fall 2007), *MAT 104* (Spring 2008)
Grader for multi-variable calculus. *MAT 201* (Fall 2006 and Spring 2007)

INVITED TALKS

Gave talks at Columbia Univeristy and Massachusetts Institute of Technology. 2009

Gave talks at University of California, Los Angeles and Northwestern University. 2008

Invited speaker for Gökova Geometry and Topology Conference and Georgia Topology Conference. 2007

Gave talks at University of Virginia, State University of New York, Buffalo, Princeton University and Columbia University. 2006

Details

A construction of knot Floer homotopy

We work with knots in S^3, and view their knot Floer homology as the homology of the grid chain complex coming from a grid diagram of the knot. We then use this chain complex to construct a CW complex with exactly one cell for each generator of the chain complex, such that the homology of the CW complex is the knot Floer homology. We then show that the CW complex is well defined and the stable homotopy type of the CW complex is a knot invariant, and thus this gives a homotopy theory corresponding to knot Floer homology.

Distinguishing Seifert surfaces using Floer homology

With Matt Hedden, András Juhász

Two Seifert surfaces for a knot are said to be equivalent if there is an isotopy of S^3 which takes one surface to another. Note that this is different from the notion of strong equivalence, where the isotopy happens in the knot complement. We produce two minimal genus Seifert surfaces for the knot 8_3 and show using sutured Floer homology as introduced by András Juhász, that these two surfaces are not equivalent. It is interesting to note that the complement of the two Seifert surfaces are homeomorphic, and the two surfaces have equivalent Seifert forms.

Maslov index of holomorphic triangles

The Heegaard Floer homology is computed by counting number of holomorphic maps from a disk with 2 marked points on its boundary to certain spaces. To be able to count, we need to have the expected dimension of the space of such maps to be 0, and this dimension is measured by the Maslov index. Lipshitz gave a purely combinatorial formula for the Maslov index, which is a big step in making this whole theory combinatorial. We produce a similar combinatorial formula for the Maslov index of maps from the disk with 3 or more points on its boundary. This has applications in understanding Heegaard Floer invariants for 4-manifolds, where we actually need such maps.

An algorithm for computing some Heegaard Floer homologies

With Jiajun Wang

Heegaard Floer homology is an invariant for 3-manifolds and knots inside 3-manifolds constructed using a Heegaard decomposition. We show that for certain types of Heegaard diagrams, the hat version of the invariant can be computed combinatorially, and then show how to construct such diagrams. This gives the first algorithm to compute the hat version of the Heegaard Floer homology.

A combinatorial description of knot Floer homology

With Ciprian Manolescu, Peter Ozsváth

Very similar to the previous paper, we construct an algorithm to compute versions of knot Floer homology. However we restrict ourselves to the case of links in S^3, which has the advantage that they can be represented by Heegaard diagrams on a torus. This allows us to compute all versions of the link Floer homology for links in S^3. This in turn gives algorithms to check if a knot is fibered, or to find the Thurston polytope of a link.

Commutators and squares in free groups

If $[x, y]$ denotes the commutator $xyx^{-1}y^{-1}$, then in any group, $[x, y]$ is always a product of three squares $[x, y] = x^2(x^{-1}y)^2y^{-2}$. We give a topological proof of the result of Lyndon and Newman that in the free group generated by x and y, $[x, y]$ is not a product of two squares. Our proof allows us to produce vast generalisations of this result.