TITLES AND ABSTRACTS

Brooke Shipley - University of Illinois at Chicago
Topological coHochschild homology for coalgebras

I will discuss joint work with Hess and others on (topological) coHochschild homology for differential graded coalgebras and for coalgebra spectra.

John Baldwin - Boston College
Khovanov homology and representations of knot groups

The Jones polynomial is an invariant of knots and links in the 3-sphere, discovered by Vaughn Jones in his work on operator algebras in the 1980s. Its introduction led quickly to the resolution of several conjectures dating back to Tait's work on knots in the 19th century. Many basic questions remain, however, regarding what exactly the Jones polynomial tells us about geometry and topology. For instance, a famous open question asks whether the Jones polynomial detects the unknot. In this talk, I'll describe progress on similar questions in the setting of Khovanov homology, a souped-up version of the Jones polynomial. The methods I'll discuss rely on connections between the Khovanov homology of a knot and SU(2) representations of the fundamental group of the knot complement.

John Francis- Northwestern University
Moduli of stratifications and factorization homology

The Ran space Ran(X) is the space of finite subsets of X, topologized so that points can collide. Ran spaces have been studied in diverse works from Borsuk-Ulam and Bott, to Beilinson-Drinfeld, Gaitsgory-Lurie and others. The alpha form of factorization homology takes as input a manifold or variety X together with a suitable algebraic coefficient system A, and it outputs the sheaf homology of Ran(X) with coefficients defined by A. Factorization homology simultaneously generalizes singular homology, Hochschild homology, and conformal blocks or observables in conformal field theory. This alpha form of factorization homology has applications to the study of mapping spaces in algebraic topology, bundles on algebraic curves, and perturbative quantum field theory. There is also a beta form of factorization homology, where one replaces the Ran space with a moduli space of stratifications, designed to overcome certain strict limitations of the alpha form. The key notion is that of a constructible bundle: in terms of its functor of points, a K-point of this moduli space is a constructible bundle over K. One application is to proving the Cobordism Hypothesis, after Baez-Dolan, Costello, Hopkins-Lurie, and Lurie. This is joint work with David Ayala.

Andy Putman - University of Notre Dame
The stable cohomology of the moduli space of curves with level structures

I will prove that in a stable range, the rational cohomology of the moduli space of curves with level structures is the same as that of the ordinary moduli space: a polynomial ring in the Miller-Morita-Mumford classes.

Clover May - University of California, Los Angeles
Decomposing C_2-equivariant spectra

Computations in $RO(G)$-graded Bredon cohomology can be challenging and are not well understood, even for $G = C_2$, the cyclic group of order two. A recent structure theorem for $RO(C_2)$-graded cohomology with coefficients in the constant Mackey functor $\underline{\mathbb{F}_2}$ substantially simplifies computations. The structure theorem says the cohomology of any finite C_2-CW complex decomposes as a direct sum of two basic pieces: cohomologies of representation spheres and cohomologies of spheres with the antipodal action. This decomposition lifts to a splitting at the spectrum level. In joint work with Dan Dugger and Christy Hazel we extend this result to a classification of compact modules over the Eilenberg-MacLane spectrum $H\underline{\mathbb{F}_2}$.

Marc Hoyois- University of Southern California
Moduli stacks of varieties and algebraic bordism

A "moduli stack of varieties" M is a functor associating to every scheme X some groupoid $\mathrm{M}(X)$ of schemes over X. An object of $\mathrm{M}(\mathbb{A}^1)$ is thus a scheme over the affine line $\mathbb{A}^1$, which we can interpret as a bordism between its fibers over 0 and 1. The $\mathbb{A}^1$-homotopy type of such a moduli stack is thus a naive algebro-geometric analog of bordism spaces in algebraic topology, which are closely related to Thom spectra by a famous theorem of Thom. I will present a version of Thoms theorem in algebraic geometry, which states that the $\mathbb{A}^1$-homotopy type of the moduli stack of proper 0-dimensional local complete intersections is the motivic Thom spectrum MGL defined by Voevodsky. This is joint work with Elden Elmanto, Adeel Khan, Vladimir Sosnilo, and Maria Yakerson.

Jo Nelson - Rice University
Equivariant and nonequivariant contact homology

Contact geometry is the study of certain geometric structures on odd dimensional smooth manifolds. A contact structure is a hyperplane field specified by a one form which satisfies a maximum nondegeneracy condition called complete non-integrability. The associated one form is called a contact form and uniquely determines a vector field called the Reeb vector field on the manifold. I will explain how to make use of J-holomorphic curves to obtain a Floer theoretic contact invariant, contact homology, whose chain complex is generated by closed Reeb orbits. In particular, I will discuss joint work with Hutchings which constructs nonequivariant and a family Floer equivariant version of contact homology. Both theories are generated by two copies of each Reeb orbit over Z and capture interesting torsion information. I will then explain how one can recover the original cylindrical theory proposed by Eliashberg-Givental-Hofer via our construction.

Zhouli Xu - MIT

The intersection form of spin 4-manifolds and Pin(2)-equivariant Mahowald invariants

A fundamental problem in 4-dimensional topology is the following geography question: "which simply connected topological 4-manifolds admit a smooth structure?" After the celebrated work of Kirby-Siebenmann, Freedman, and Donaldson, the last uncharted territory of this geography question is the "11/8-Conjecture". This conjecture, proposed by Matsumoto, states that for any smooth spin 4-manifold, the ratio of its second-Betti number and signature is least 11/8.

Furuta proved the "10/8+2"-Theorem by studying the existence of certain Pin(2)-equivariant stable maps between representation spheres. In this talk, we will present a complete solution to this problem by analyzing the Pin(2)-equivariant Mahowald invariants of powers of certain Euler classes in the RO(Pin(2))-graded equivariant stable homotopy groups of spheres. In particular, we improve Furuta's result into a '"10/8+4"-Theorem. Furthermore, we show that within the current existing framework, this is the limit. For the proof, we use the technique of cell-diagrams, known results on the stable homotopy groups of spheres, and the j-based Atiyah-Hirzebruch spectral sequence.

This is joint work with Michael Hopkins, Jianfeng Lin and XiaoLin Danny Shi.