Titles and abstracts

NEAT MAPS 2025 - BU

November 15, 2025

Miriam Kuzbary (Amherst College), *Thinking about dimension 4, stuck in dimension 3: Knots, Concordances, and Homology Cobordisms*

It is a common theme in topology to study n-manifolds based on the $(n-1)$-manifolds they bound, or the $(n+1)$-manifolds bounded by them. We'll explore together why this is an interesting and useful thing to do in dimensions 3 and 4! More specifically, we will talk about knots in the 3-sphere which are secretly related in 4-dimensional ways and how this can help us think about 3-manifolds that are similarly mysteriously connected.

Vasily Krylov (Harvard/CMSA), *Coulomb Branches and Geometric Representation Theory*

In 2016, Braverman, Finkelberg, and Nakajima gave a mathematical definition of Coulomb branches of 3-dimensional topological quantum field theories associated with a reductive group and its complex representation. Coulomb branches had been extensively studied from various physical perspectives, and this definition provided a concrete mathematical framework that made it possible to rigorously formulate and further develop many of those ideas within mathematics. The Coulomb branch is an affine Poisson variety.

In this talk, I will review the theory of Coulomb branches and explain how they naturally arise in geometric representation theory and 3d mirror symmetry (also known as symplectic duality). Time permitting, I will discuss one concrete application allowing us to construct an isomorphism between certain completions of Yangians and of quantum groups (purely algebraic objects) by applying topological methods to Coulomb branches.

Ismar Volić (Wellesley College), *Manifold calculus of functors for r-immersions*

Manifold calculus of functors has for over twenty years been successfully used for studying spaces of embeddings, but the theory also applies to related spaces of r-immersions, which are immersions where no more than $r - 1$ points are allowed to equal (embeddings are thus 2-immersions). I will give some background on manifold calculus of functors and then present some recent work on understanding the manifold calculus Taylor tower that approximates the space of r-immersions. Manifold calculus in this context supplies interesting connections to combinatorial topology, such as the structure of certain subspace arrangements as well as Tverberg-like problems, so some time will be devoted to these topics.

Andew Reisen (MIT), *Interpolating Feigin-Frenkel Duality at the Critical Level to Matrices of Complex Size*

In this talk, I will explain how Feigin–Frenkel duality at the critical level extends to the setting of complex rank. Working in Deligne's interpolating categories, we define universal affine vertex algebras and describe their centers at the critical level by interpolating Molev's construction of Segal–Sugawara vectors. Using Feigin's Lie algebras of complex rank $\mathfrak{gl}_\lambda$, we identify natural generators of their Drinfeld–Sokolov reductions $\mathscr{W}(\mathfrak{gl}_\lambda)$, and show that the interpolated Feigin–Frenkel isomorphism maps the Segal–Sugawara vectors to these generators.

Sidharth Soundararajan (Boston University), *SYZ mirror symmetry for del Pezzo surfaces*

Mirror symmetry was first discovered as a duality between the symplectic geometry of a Calabi-Yau manifold and the complex geometry of its mirror. The Strominger-Yau-Zaslow (SYZ) conjecture provides a recipe to construct the mirror manifold. The conjecture also extends to log Calabi-Yau surfaces. In this talk, I will discuss the proof of the conjecture for del Pezzo surfaces. This is joint work with Tsung-Ju Lee and Yu-Shen Lin.

Eunice Sukarto (Harvard), *Power operations modulo Lubin-Tate parameters*

Power operations in Morava E-theory have been studied by Rezk. We consider analogous theories of power operations modulo sequences of Lubin-Tate parameters. Rezk shows that the algebra of additive operations is Koszul. We show that its analogs modulo Lubin-Tate parameters are Koszul and are related by cofiber sequences. This allows us to inductively show that certain Tor groups over the algebra of additive operations vanish in nonzero degrees. These Tor groups compute the linearization/indecomposables of the E_2-page of a bar spectral sequence converging to the graded E-cohomology of configuration spaces on R^n. This is joint work with Andrew Senger.

Grisha Taroyan (University of Toronto), *de Rham Theory in Derived Differential Geometry*

In the talk, I will describe recent progress in building a version of de Rham theory for derived manifolds and derived differentiable stacks. Derived differential geometry is a nascent field applying techniques from derived algebraic geometry to the study of spaces with smooth structures. As such, it serves as a natural home for studying objects arising in BV formalism. For instance, concepts such as critical loci of action functionals or their quotients by gauge actions can be naturally interpreted as derived differentiable stacks. In our work, we build a version of de Rham theory for these spaces and prove a version of the de Rham isomorphism. Due to the highly singular nature of all objects involved, developing such a theory is significantly more challenging than in the usual differential geometry, and thus, we construct our formalism with inspiration from algebraic geometry rather than classical differential topology. As a main application of the developed theory, we obtain a version of the comparison morphism between de Rham and constant sheaf cohomology arising from the corresponding map of stacks. This should enable further developments, with a view towards a fully-fledged theory of shifted symplectic structures for derived differentiable stacks. The talk is based on a preprint of the same name, arXiv:2505.03978.