NEAT MAPS March 2024 Titles and Abstracts

March 16–17, 2024

Invited Lectures

Charles Doran (Bard College)

Title: Supergeometry of Adinkras and (Quantum) Error Correcting Codes

Abstract: Supermultiplets in particle physics, stripped of their spatial dimensions, can be described in terms of a class of N-edge regular bipartite decorated graphs known as Adinkras. We will start by explaining how to construct all of these from quotients of the 1-skeleton of binary N-dimensional hypercubes by doubly even binary linear error correcting codes. We then geometrize these graphs, realizing them on Riemann surfaces arising as rigid branched covers of the thrice-punctured sphere. The additional markings on an Adinkra can then be reinterpreted as providing special spin structures and divisors coming from discrete Morse functions. Applying Kitaev's surface code construction yields an associated quantum error-correcting code. The supersymmetric origin and extra markings suggest ingredients for a supersymmetric extension of the surface code as well as a form of mirror symmetry.

Owen Gwilliam (University of Massachusetts, Amherst

Title: Holomorphic gauge theories and factorization algebras

Abstract: Abstract: Physics has gifted mathematics several beautiful conjectures and examples in the form of topological field theories — including Seiberg-Witten invariants of 4-manifolds and mirror symmetry — which arise by "twisting" supersymmetric field theories and their dualities. We will describe another type of "twist" that produces holomorphic field theories and examine some of the problems and possibilities suggested by various examples. Given time, we will describe work in progress on a holomorphic form of Seiberg duality for 4-dimensional gauge theories or holomorphic aspects related to Kapustin-Witten theories (and hence the geometric Langlands program).

Xin Jin (Boston College)

Title: Mirror Symmetry for the Affine Toda Systems

Abstract: Abstract: I'll present recent work on mirror symmetry for the affine Toda systems, which can be viewed as a Betti Geometric Langlands correspondence (after Ben-Zvi—Nadler) in the wild setting. More explicitly, we realize the affine Toda system (associated to a complex semisimple group) as a moduli space of Higgs bundles on $\mathbb{P}^1$ with certain automorphic data, and the dual side is the group version of the universal centralizer (associated to the dual group), which is a wild character variety. We show that the wrapped Fukaya category of the former is equivalent to the category of coherent sheaves of the latter. The proof uses my previous result on the mirror symmetry for the (usual) Toda systems, also known as the universal centralizers. This is joint work with Zhiwei Yun.

Martina Rovelli (University of Massachusetts, Amherst

Title: n-Complicial sets as a model for (oo,n)-categories

Abstract: Abstract: The formalism of extended TQFTs relies the notion of an (∞, n)-category: a categorical structure with morphisms in each dimension, which can be composed in a weakly associative way, and which are weakly invertible in dimension higher than n. In this expository talk I will describe the notion of an n-complicial set, explain the intuition for how this implements the idea of an (∞, n)-category, and discuss some of the advantages and disadvantages of this approach.

Contributed Lectures

Keshav Dahiya (Indiana University)

Title: Intertwiners of representaions of quantum affine algebras and Yangians

Abstract: The trigonometric and rational R-matrices are operators acting in the tensor squares of representations of quantum affine algebras and Yangians respectively. We give explicit expressions of these operators for the first funadamental representations of all (twisted and untwisted) quantum affine algebras and Yangians, in terms of certain projectors and matrix units.

Porter Morgan (University of Massachusetts, Amherst

Title: Nonorientable broken Lefschetz fibrations

Abstract: Lefschetz fibrations are a special type of map from a 4-manifold to a surface, usually either S^2 or D^2. Although they provide a lot of information about their source manifold, they're only admitted by a limited collection of 4-manifolds. This motivates the study of broken Lefschetz fibrations; by relaxing the definition of a Lefschetz fibration, we get a family of maps that all closed, smooth 4-manifolds admit. In this talk, we'll review the basic topology of broken Lefschetz fibrations, both in the more-established orientable case, and in the more-recent nonorientable case. We'll examine the data that such a map provides, and see how we can obtain a broken Lefschetz fibration from a more general map onto S^2.

Lorenzo Riva (Notre Dame)

Title: Constructing higher categories with desired properties

Abstract: In this talk we will sketch the construction of a family of symmetric monoidal $(\infty, 3)$-categories which is motivated by the Rozansky-Witten field theories of Kapustin, Rozansky, and Saulina (arXiv:0810.5415, 0909.3643) and the (∞, n)-category of higher Lagrangian correspondences of Calaque, Haugseng, and Scheimbauer (arXiv:2108.02473). The underlying framework has "generalized spans" in some ∞-category $\mathcal{C}$ and at the top level these spans are equipped with a symmetric monoidal ∞-category parametrized by $\mathcal{C}$; the objects of the latter compose with a push-pull formula resembling the Fourier-Mukai transform of algebraic geometry. We apply the construction to get an approximation of the Rozansky-Witten 3-category and extend some dualizability results of Brunner, Carqueville, and Roggenkamp (arXiv:2201.03284).

Johnathon Taylor (Case Western Reserve

Title: Picard n-categories as 2-truncated $(n + 2)$-categories

Abstract: A Picard n-category is a symmetric monoidal n-category with tensor inverses for cells up to degree $n-1$. We describe the method of defining a Picard n-category as a 2-truncated $(n + 2)$-category for small dimensions.

We then discuss the problem of obtaining a general Picard n-category using this methodology for large enough n.