Submittee: Jim Bryan
Date Submitted: 2014-07-07 15:02
Title: String Math Summer School
Event Type: Summer-School

Location:
PIMS Vancouver

Dates:
June 2nd -- June 6th, 2014

Topic:
Geometry and Physics

Methodology:
Five senior people (Zaslow, Pantev, Costello, Neitzke, and Szendroi) in the general area of geometry and physics each gave a series of four lectures aimed at postdocs and senior graduate students. // There was also three additional "discussion sessions" led by a dynamic young person in the field (Theo Johnson-Freyd) who organized students to break into group and discuss in detail issues and or examples that arose during the lectures. //

Objectives Achieved:
The summer school succeeded in its objective of presenting cutting edge research topics in a way accessible to young people. // The summer school also provided a forum where young people were able to meet and work with other young researchers in their field as well as the senior people. //

Organizers:
Bryan, Jim, Mathematics, UBC.

Speakers:
Kevin Costello (Northwestern). // Towards the mathematics of type IIB superstring theory and AdS/CFT. // Supsersymmetric objects in physics often have twistings which are much easier to analyze mathematically than the full untwisted theory. // This course will focus on twisted supersymmetric gauge theories which arise from D-branes in type IIB string theory. // We will discuss how to define these twisted theories mathematically, and we will rederive some results in the physics literature. // I will also spend a little time explaining twisted type IIB supergravity and a conjectural mathematical formulation of the AdS/CFT correspondence. // Andy Neitzke (Texas). // Open string mirror symmetry and Hitchin's equations // Suppose given a complex curve C and a Lie group G. // From these data one can construct an interesting system of nonlinear PDEs known as Hitchin's equations. // The moduli space of solutions of these equations has the marvelous property

of being hyperkahler: it thus has various avatars corresponding to its different complex structures, including one in which it is a complex integrable system, and another in which it is the moduli space of complex flat connections. One difficulty in understanding the nature of this space is that its hyperkahler structure is difficult to write down explicitly. // I will explain some aspects of a strategy for constructing the hyperkahler structure concretely; this strategy appeared in joint work with Davide Gaiotto and Greg Moore, motivated by the problem of BPS state counting in supersymmetric quantum field theory. // Depending on one's point of view, one might view this strategy either as an application of the exact WKB method for differential equations depending on a small parameter, or as an application of mirror symmetry; the "Stokes curves" appearing in the former approach get related to "holomorphic triangles" appearing in the latter. // Tony Pantev (University of Pennsylvania). // Shifted structures and quantization. // I will introduce a version of algebraic symplectic geometry that is suitable for dealing with derived or stacky resolutions of singular spaces. // I will explain how this generalization arises naturally in the study of moduli spaces and will outline interesting connections to ordinary symplectic geometry. // I will also give non-trivial examples and will describe a several constructions of shifted symplectic structures. // In addition I will discuss a number of topics on the structure theory of derived symplectic stacks, including the Darboux theorem, the existence of isotropic and Lagrangian structures, constructions of derived lagrangian foliations, existence of shifted potentials, and various results in the direction of shifted quantization and formality. // The lectures are based on various joint works with Calaque, Katzarkkov, Toen, Vaquie, and Vezzosi. // Balazs Szendroi (Oxford). // Cohomological Donaldson-Thomas theory. // I will start with a summary of the aims and objectives of Donaldson-Thomas theory, the theory of attaching invariants to moduli spaces of sheaves on Calabi-Yau threefolds and more generally objects in 3-Calabi-Yau categories. // I will discuss what's known about the local and global structure of such moduli spaces. // After a technical interlude on constructible sheaves, vanishing cycles and mixed Hodge modules, I will introduce the main construction, cohomological DT invariants. // I will then concentrate on a local model, categories of representations of a quiver with potential, introducing the Kontsevich-Soibelman COHA, which is an algebra structure on cohomological DT. // If time permits, I will discuss wall crossing, and an application of the theory in the study of quantum cluster transformations. // Eric Zaslow (Northwestern). // Knots, Sheaves and Physics. // I will discuss various relationships between Legendrian knots, constructible sheaves, and the Fukaya category. // Lecture 1: Legendrian knots, the Chekanov-Eliashberg dga, and the category of augmentations. // Lecture 2: Microlocalization: constructible sheaves and the Fukaya category. // Lecture 3: Sheaf-theoretic perspective on Legendrian knots, microlocal monodromy, recovery of topological knot invariants. // Lecture 4: Comments on higher dimensions and the relationship to the Hitchin system. //

Links:
