Algebraic and Symplectic Geometry of Moduli Spaces
AlgeGéométrie algébrique et symplectique des espaces de modules
(Org: **Derek Krepski** (University of Manitoba) and/et **Steven Rayan** (University of Saskatchewan))

JIM BRYAN, University of British Columbia
Curve counting on (K3xE)/G and Siegel modular forms

For a cyclic group G of order N acting symplectically on a $K3$ surface S and by translation on an elliptic curve E, we consider the Calabi-Yau threefold X given by $X = (S \times E)/G$. We conjecture that the Donaldson-Thomas partition function of X is given by a certain genus 2 Siegel modular form Φ_N which is of weight $\lceil \frac{24}{N+1} \rceil - 2$. We provide strong evidence for the conjecture and discuss the connection with CHL models in physics, Mathieu moonshine, and elliptic genera.

SABIN CAUTIS, UBC
The coherent Satake category

The affine Grassmannian Gr_G of a reductive group G is the moduli space of pairs (V, ϕ) where V is a principle G-bundle on the disk and ϕ is a trivialization of it away from zero. I will discuss the structure of the category of coherent sheaves on Gr_G (a.k.a. the coherent Satake category).

AJNEET DHILLON, University of Western Ontario
Essential Dimension of the moduli stack of vector bundles.

We will discuss some joint work with Indranil Biswas and Norbert Hoffmann on the essential dimension of the moduli stack of vector bundles over a curve. The essential dimension is the number of parameters required to describe a generic family of vector bundles.

CHARLES DORAN, University of Alberta
Moduli of K3 Surface Fibered Calabi-Yau Threefolds

We introduce a generalization of Kodaira's theory of elliptic surfaces for threefolds fibered by lattice polarized K3 surfaces. Specializing to fibers of "nearly maximal" Picard rank, we obtain a complete classification (and construction!) for these Calabi-Yau threefolds. The class includes the famous "quintic mirror" and its Hodge-theoretic analogues. This is joint work with Andrew Harder, Andrey Novoseltsev, and Alan Thompson.

MICHAEL GROECHENIG, University of Toronto
Mirror symmetry for Higgs bundles and the fundamental lemma

The fundamental lemma is an identity of integrals central to the Langlands programme. Despite its ostensibly combinatorial nature, it resisted all direct efforts to verify it, until Ngô finally proved it in 2008. One of the unexpected features of Ngô's argument, was the important role played by the moduli space of Higgs bundles. His proof infers the fundamental lemma from a statement about the cohomology of moduli spaces of Higgs bundles, called geometric stabilisation.

In this talk I'll discuss a new perspective on geometric stabilisation, provided by p-adic integration. We will see that there exists a close philosophical link between mirror symmetry for moduli spaces of Higgs bundles (à la Hausel-Thaddeus) and the fundamental lemma. This is joint work with Wyss and Ziegler.

OLIVER LEIGH, University of Melbourne and University of British Columbia
Stables Maps with Divisible Ramification

A generic point in the moduli space stable maps to a curve corresponds to a map which has only simply ramification. In this talk we consider another space, where a generic point will correspond to a map which has only ramification of order r, for some fixed integer $r > 0$. We construct a natural compactification of this space and explore its properties. This includes the construction of a virtual fundamental class in genus 0.

ALESSANDRO MALUSÀ, University of Saskatchewan, PIMS
Some aspects on the AJ conjecture

In its original formulations, the AJ conjecture, which gives a strong relation between the A-polynomial and the coloured Jones, takes inspiration from their meaning for the $\mathrm{SU}(2)$-Chern-Simons theory, so that an analogous statement is expected within the $\mathrm{SL}(2,\mathbb{C})$ version of the theory. In a joint work with Andersen, we propose a precise formulation of this, which we prove to hold true for the first two hyperbolic knots. The statement is obtained by using the so-called Weil-Gel'fand-Zak transform to bring together two different approaches to $\mathrm{SL}(2,\mathbb{C})$-Chern-Simons theory (for genus one): the Teichmüller TQFT and geometric quantisation on the moduli space of flat connections.

In this presentation I will discuss some aspects of the work mentioned above, with a particular stress on the side of geometric quantisation.

RUXANDRA MORARU, University of Waterloo
Moduli spaces of generalized holomorphic bundles

Generalized holomorphic bundles are the analogues of holomorphic vector bundles in the generalized geometry setting. For some generalized complex structures, these bundles correspond to co-Higgs bundles, flat bundles or Poisson modules. I will give an overview of what is known about generalized holomorphic bundles, and describe their moduli spaces in some specific examples. Part of this is joint work with Shengda Hu and Mohamed El Alami, as well as Alejandra Vicente Colmenares and Vasile Brînzănescu.

SETH WOLBERT, University of Manitoba
Diffeological coarse moduli spaces for stacks over manifolds

In this talk, I will give a brief introduction to diffeologies, a relatively simple model for endowing singular spaces with smooth structure. I will also discuss how one may naturally use an alternative identification of diffeologies as a certain type of sheaf to build a diffeological coarse moduli spaces for any stack over the site of smooth manifolds.