**Fibrations, Mirror Symmetry and Calabi-Yau Geometry**
**Fibrations, symétrie miroir et géométrie de Calabi-Yau**
(Org: **Charles Doran** (Alberta), **Andreas Malmendier** (Utah State) and/et **Alan Thompson** (Waterloo))

**LARA ANDERSON**, Virginia Tech
*Heterotic and F-theory Compactifications and Geometry*

We systematically analyze a broad class of dual heterotic and F-theory models that give rise to six- and four-dimensional supergravity theories, and compare geometric constraints on the two sides of the duality. In this talk we will demonstrate that both theories together give new insight into the space of possible effective theories arising from string theory. We will describe explicit new results regarding elliptic and K3-fibration structures and string dualities.

**MBOYO ESOLE**, Harvard University
*Geometric Engineering of SU(3) SU(2) through Elliptic Fibrations: Resolutions and Flops.*

I will review the different ways to engineer a SU(2)SU(3) gauge theory using elliptic fibrations and discuss the resulting geometry. In particular, I will present many new non-Kodaira fibers that naturally occur in this setting. I will also discuss the network of flops between different nonsingular elliptic fibrations sharing the same Jacobian (Weierstrass model).

**ANTONELLA GRASSI**, University of Pennsylavania
*Birational Geometry of Higher dimensional elliptic fibrations*

I wil present comparison and differences between Calabi Yau threefolds and fourfolds which are elliptically fibered.

**ANDREW HARDER**, University of Alberta
*Tyurin degenerations, K3 fibrations and the Batyrev-Borisov construction*

If a Calabi-Yau threefold degenerates to the normal crossings union of a pair of quasi-Fano threefolds, then mirror symmetry predicts that there is a corresponding K3 fibration on the mirror Calabi-Yau threefold. I will show that this prediction is compatible with the Batyrev-Borisov mirror construction, and I will discuss how the resulting K3 fibration reflects the mirror-dual degeneration.

**ATSUSHI KANAZAWA**, Harvard CMSA
*Holomorphic symplectic geometry of the space of Bridgeland stability conditions*

For a Calabi-Yau triangulated category D of odd dimension, the space Stab(D) of Bridgeland stability conditions on D is naturally a holomorphic symplectic manifold. I will discuss geometry of Lagrangian submanifolds of Stab(D) in comparison with the Donagi-Markman integrable system. I will also explain our attempt to identify the gauged Kahler moduli space inside Stab(D) when D comes from Calabi-Yau geometry. This is a joint work with Y.-W. Fan and S.-T. Yau.

**ALEX MOLNAR**, Queen's University
*On Calabi-Yau threefolds of CM-type*

The first known examples of elliptic curves satisfying the Birch and Swinnerton-Dyer conjecture were elliptic curves with complex multiplication. With this in mind, one may try to study the Beilinson-Bloch conjecture for (rigid) Calabi-Yau threefolds by first examining (rigid) Calabi-Yau threefolds of CM-type.

We will discuss an elementary construction of such threefolds (over the complex numbers) towards a classification up to birational equivalence, as well as the limits of this approach and an expected classification. We will also briefly mention how, specifically, the CM-type allows us to achieve arithmetic results.

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**SIMON ROSE**, Copenhagen University
*Quasi-modularity of generalized sum-of-divisors functions*

In this talk I will present a generalization of the sum-of-divisors introduce by P. A. MacMahon, and show how they are quasi-modular forms. I will finish with some speculation as to the geometric significance of these functions.

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**EMANUEL SCHEIDEGGER**, Freiburg

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**EGOR SHELUKHIN**, Institute for Advanced Study
*Non-trivial Hamiltonian fibrations via K-theory quantization*

We show how quantization of families with values in K-theory can detect non-trivial Hamiltonian fibrations, yielding examples that are not detected by previous methods (the characteristic classes of Reznikov for example). We also upgrade a theorem of Spacil on the cohomology-surjectivity of a natural map of classifying spaces by providing it with an "almost" weak retraction. Joint work with Yasha Savelyev.

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**WASHINGTON TAYLOR**, MIT
*Classification and enumeration of elliptic Calabi-Yau threefolds and fourfolds*

Recent work motivated by physics has led to progress in understanding elliptic Calabi-Yau threefolds and fourfolds, using new mathematical and computational tools for analyzing the geometry of the bases that support such fibrations. This talk will give an introduction to some aspects of this research program, including: the identification (work with D. Morrison) of irreducible geometric structures in the base geometry that facilitate the classification of allowed bases, connections between codimension two singularities and representation theory, Mordell-Weil groups, a systematic approach to enumerating elliptic Calabi-Yau threefolds with large $h_{2,1}$, and a Monte Carlo study of $\sim 10^{50}$ distinct toric threefold bases that support elliptic Calabi-Yau fourfolds. A brief description will also be given of applications to physics including hints at how the observed standard model of particle physics may emerge from "typical" features of Calabi-Yau fourfolds.

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**URSULA WHITCHER**, University of Wisconsin-Eau Claire
*Arithmetic Mirror Symmetry and Isogenies*

Arithmetic mirror symmetry is a relationship between the number of points on appropriately chosen mirror pairs of Calabi-Yau varieties over finite fields. We investigate whether arithmetic mirror relationships observed for diagonal pencils in weighted projective spaces can be extended to mirror families obtained via the Batyrev-Borisov construction. Our results show that arithmetic mirror symmetry is controlled by an isogeny structure. This talk describes joint work with Christopher Magyar.