Fibrations and Degenerations in Algebraic Geometry
Fibrations et Dégénérations en Géométrie Algébrique
(Org: **Chuck Doran** (Alberta) and/et **Andrew Harder** (Lehigh))

ADRIAN CLINGHER, University of Missouri - St. Louis
On K3 surfaces of Picard rank 14

In this talk, I will present a study of complex K3 surfaces polarized by rank-fourteen, two-elementary lattices. This study includes birational models for these surfaces, as quartic projective hypersurfaces and a description of the associated coarse moduli spaces. I will also discuss a classification of all present Jacobian elliptic fibrations. This is joint work with A. Malmendier.

ELANA KALASHNIKOV, Harvard University

MATT KERR, Washington University in St. Louis
Frobenius constants and limiting mixed Hodge structures

I explain how the Mellin transform of a variation of Hodge structure computes extension classes in its limit. In particular, it produces both a formula and a motive for the LMHS in the hypergeometric case.

JORDON KOSTIUK, Brown University
Geometric Variations of Local Systems

Geometric variations of local systems are families of variations of Hodge structure; they typically correspond to fibrations of Kähler manifolds for which each fibre itself is fibred by codimension-one Kähler manifolds. In this talk, I introduce the formalism of geometric variations of local systems and then specialize the theory to study families of elliptic surfaces. I will explain some of the computational challenges that go into computing geometric variations of Hodge and highlight examples coming from elliptically fibred K3-surfaces and K3-surface fibred Calabi-Yau threefolds.

SUKJOO LEE, University of Pennsylvania
The mirror P=W conjecture from Homological Mirror Symmetry

The mirror P=W conjecture, recently formulated by A.Harder, L.Katzarkov and V.Przyjalkowski, is a refined Hodge number symmetry between a log Calabi-Yau mirror pair $(U, U^\vee)$. It predicts that the weight filtration on the cohomology $H^\bullet(U)$ is equivalent to the perverse filtration on the cohomology $H^\bullet(U^\vee)$ associated to the affinization map. One can see this phenomenon from the categorical viewpoint when U admits a Fano compactification (X, D) where X is a smooth Fano and D is a smooth anti-canonical divisor. I will go over this story and generalize it to the case when D has more than one component.

DANIEL LOPEZ, Instituto de Matematica Pura e Aplicada (IMPA)
Homology supported in Lagrangian submanifolds in mirror quintic threefolds

In this talk, we study homology classes in the mirror quintic Calabi-Yau threefold which can be realized by Lagrangian submanifolds. We have used Picard-Lefschetz theory to establish the monodromy action and to study the orbit of Lagrangian vanishing cycles. For many prime numbers p we can compute the orbit modulo p. We conjecture that the orbit in homology with coefficients in $\mathbb{Z}$ can be determined by these orbits with coefficients in $\mathbb{Z}_p$.

TOKIO SASAKI, University of Miami
Limits of geometric higher normal functions and Apéry constants

The irrationality of $\zeta(3)$ was historically proven by R. Apéry via the approximation by the ratio of two sequences of integers. For each of five Mukai Fano threefolds with Picard rank 1, V.Golyshev obtained a special value of L-function as the ratio of similar two sequences which arise from the quantum recursion. In terms of the mirror symmetry, this construction in the A-model side can be generalized to Fano threefolds with Picard rank 1. The Arithmetic Mirror Symmetry Conjecture states that a corresponding construction in the B-model side will be obtained from the limits of geometric higher normal functions. In this talk, we show that this conjecture holds for five Golyshev's examples by constructing specific higher Chow cycles. This is joint work with V. Golyshev and M. Kerr.

ALAN THOMPSON, Loughborough University
Mirror Symmetry for Fibrations and Degenerations

In a 2004 paper, Tyurin briefly hinted at a novel relationship between Calabi-Yau mirror symmetry and the Fano-LG correspondence. More specifically, if one can degenerate a Calabi-Yau manifold to a pair of (quasi-)Fanos, then one expects to be able to express the mirror Calabi-Yau in terms of the corresponding Landau-Ginzburg models. Some details of this correspondence were worked out by C. F. Doran, A. Harder, and I in a 2017 paper, but much remains mysterious.

In this talk I will describe recent attempts to better understand this picture, and how it hints at a broader mirror symmetric correspondence between degeneration and fibration structures. As an example of this correspondence, I will discuss the question of finding mirrors to certain exact sequences which describe the Hodge theory of degenerations.

The material in this talk is joint work in progress with C. F. Doran.

URSULA WHITCHER, Mathematical Reviews