THE FIELDS INSTITUTE
FOR RESEARCH IN MATHEMATICAL SCIENCES

ABSTRACTS 1.2

BOBBY ACHARYA
Abdus Salam ICTP

Statistics of M theory vacua and the Landscape

ANIRBAN BASU
University of Chicago

$(0, 2)$ *Duality*

I shall discuss the construction of dual descriptions of $(0, 2)$ gauged linear sigma models. In some cases, the dual is a $(0, 2)$ Landau-Ginzburg theory, while in other cases, it is a non-linear sigma model. The duality map defines an analogue of mirror symmetry for $(0, 2)$ theories. Using the dual description, I shall discuss how to determine the instanton corrected chiral ring for some illustrative examples. This ring defines a $(0, 2)$ generalization of the quantum cohomology ring of $(2, 2)$ theories.

CHRISTOPHER E. BEASLEY
Princeton University

New Instanton Effects in N=1 Supersymmetric String Compactifications

I will discuss a new class of multi-fermion F-terms that can appear in the effective actions of N=1 supersymmetric theories. Among other effects, such F-terms generate complex structure deformations of the moduli space of supersymmetric vacua of the theory. I will explain how these F-terms can be generated by instantons in N=1 supersymmetric string compactifications. Specifically, in the context of heterotic Calabi-Yau compactification, I will describe how worldsheet instantons can induce complex structure deformations of the moduli space. This talk is based on joint work with Edward Witten.

MELANIE BECKER
University of Maryland

Flux Compactifications, Cosmology and the Standard Model of Elementary Particles

In this talk I shall discuss flux compactifications of M-theory and string theory and study their implications for Cosmology and the Standard Model of Elementary Particles.

THE FIELDS INSTITUTE
FOR RESEARCH IN MATHEMATICAL SCIENCES

ABSTRACTS 1.2

VOLKER BRAUN
University of Pennsylvania

A Heterotic Standard Model

We recently found a realistic compactification of the heterotic string theory which yields just the standard model gauge group with an extra $U(1)_{B-L}$ factor and no exotic matter. In my talk, I am going to explain our construction in detail. First we construct a torus fibered Calabi-Yau threefold with enough Wilson lines. Then we find a suitable E_8 instanton to break the gauge group down to our extended standard model gauge group. Finally, we compute the low energy spectrum and find three generations without any exotic matter. Especially, doublets and triplets are split in the right way.

RALPH BLUMENHAGEN
Munich, Max Planck Institute

Recent Progress with Intersecting D-brane models

FREDERIK DENEF
Rutgers University

Landscape studies

RON DONAGI
University of Pennsylvania

Geometric transitions, integrable systems, and large N duality

BOGDAN FLOREA
Rutgers University

Moduli Stabilization in F-Theory Compactifications

We discuss examples of F-theory compactifications on a Calabi-Yau fourfold where background fluxes, together with nonperturbative effects from Euclidean D3 instantons and gauge dynamics on D7 branes allow us to fix all closed and open string moduli.

THE FIELDS INSTITUTE
FOR RESEARCH IN MATHEMATICAL SCIENCES

ABSTRACTS 1.2

MARIANA GRANA
Ecole Normale Superieur-Paris

Hitchin Functionals in Supergravity

We discuss type II theories in space-time backgrounds that admit an $SU(3)$ structure. We will see that the couplings strongly resemble those of four-dimensional N=2 supergravity. Specifically, we show that the moduli space of metrics are special Kahler manifolds with Kahler potentials given by the Hitchin functionals. We also compute the N=2 version of the superpotential in this language, and find its N=1 counterpart.

SERGEI GUKOV
Harvard University

Heterotic Moduli Stabilization with Fractional Chern-Simons Invariants

We show that fractional flux from Wilson lines can stabilize the moduli of heterotic string compactifications on Calabi-Yau threefolds. We observe that the Wilson lines used in GUT symmetry breaking naturally induce a fractional flux. When combined with a hidden-sector gaugino condensate, this generates a potential for the complex structure moduli, Kahler moduli, and dilaton. This potential has a supersymmetric AdS minimum at moderately weak coupling and large volume. Notably, the necessary ingredients for this construction are often present in realistic models. We explore the type IIA dual phenomenon, which involves Wilson lines in D6-branes wrapping a three-cycle in a Calabi-Yau, and comment on the nature of the fractional instantons which change the Chern-Simons invariant.

RUBEN MINASIAN
Ecole Polytechnique

On mirror symmetry with fluxes and branes

The first part of the talk will be a review of the necessary conditions for the supresymmetric string backgrounds with fluxes, and a formulation of a mirror symmetry proposal in these backgrounds. A fiberwise T-duality picture of this proposal and incorporation of D-branes will be discussed in the second part.

THE FIELDS INSTITUTE
FOR RESEARCH IN MATHEMATICAL SCIENCES

ABSTRACTS 1.2

MICHAEL B. SCHULZ
California Institute of Technology

Mapping Flux to Geometry

$D3/D7$-type flux compactifications are an exciting arena in which we have begun to address important problems in string theory and its applications to cosmology and particle physics – notably moduli stabilization, vacuum statistics, realizations of de Sitter space and inflation, and soft supersymmetry breaking in MSSM-like models. Given their relevance, we would like to understand which warped compactifications represent new string string vacua, and which are just alternative descriptions of more conventional fluxless compactifications.

In this talk, we take a first step toward this larger goal in the friendlier confines of $N = 2$ supersymmetry. We study a duality that relates the simplest $N = 2$ warped compactifications to standard fluxless Calabi-Yau compactifications of type IIA string theory. Using the duality map, we show that the Calabi-Yau manifolds that arise are abelian surface (T^4) fibrations over P^1. We compute a variety of properties of these threefolds, including Hodge numbers, intersection numbers, discrete isometries, and $H_1(X, Z)$. In addition, we show that S-duality in the orientifold description becomes T-duality of the abelian surface fibers in the dual Calabi-Yau description.

GARY SHIU
University of Wisconsin/Perimeter Institute

Building Chiral Flux Vacua

Moduli stabilization and supersymmetry breaking are among the outstanding problems in string phenomenology. Type IIB compactification with fluxes has shown to provide a concrete framework to analyze these two problems simultaneously in a controlled stringy manner. To explore quantitative issues of this scenario, however, it is essential to construct some explicit models where the Standard Model is embedded. In this talk, I will describe the first examples of such MSSM flux vacua and discuss issues involved in these constructions.

ALESSANDRO TOMASIELLO
Stanford University

Towards generalized complex mirror symmetry

Conditions for flux compactifications can be classified by $SU(3)$ structures. Generalized complex geometry helps to order the array of possibilities. The resulting picture agrees with indications on mirror symmetry with fluxes coming from several sources (T–duality,

spontaneous supersymmetry breaking, A and B models). The topology of mirror symmetry with fluxes can then be used to produce explicit examples, and to check what kind of "massive cohomology" we need for general $SU(3)$ structure compactifications.