

Events

From 18/05 to 22/05/2009

May 2009							June 2009						
M	T	W	T	F	S	S	M	T	W	T	F	S	S
				1	2	3	1	2	3	4	5	6	7
4	5	6	7	8	9	10	8	9	10	11	12	13	14
11	12	13	14	15	16	17	15	16	17	18	19	20	21
18	19	20	21	22	23	24	22	23	24	25	26	27	28
25	26	27	28	29	30	31	29	30					

Monday, 18 May

• Events

■ **09:00 to 09:00 Registration**

■ **09:30 to 09:45 Murayama: Opening address**

■ **09:45 to 11:45 Szendroi: The refined topological vertex and virtual Poincare polynomials**

Notes: The purpose of my talks is to define and compute a deformation of the Donaldson–Thomas sheaf counting invariants on local Calabi–Yau threefolds. The computations will make precise contact with the refined topological vertex formulae of Iqbal–Kozcaz–Vafa, clarifying some aspects of the latter. Examples presented will include the Hilbert scheme of points on $\mathbb{C}P^3$ and the full DT theory and its variants on the resolved conifold. I will comment also on the current obstructions to globalizing the construction. Some of this is joint work with Dimca, respectively Behrend and Bryan.

■ **13:00 to 15:00 Bryan: The orbifold topological vertex and the Donaldson–Thomas crepant resolution conjecture**

Notes: We discuss the Donaldson–Thomas invariants of a Calabi–Yau orbifold X and its Calabi–Yau resolution Y . The relationship between the DT invariants of X and Y is given by the Crepant Resolution Conjecture which we formulate. We also discuss the relationship with the Gromov–Witten invariants of X and Y and the Gromov–Witten Crepant Resolution Conjecture. Our main computational tool is the orbifold topological vertex, which is a formalism we develop to compute the Donaldson–Thomas invariants of toric Calabi–Yau orbifolds.

■ **15:30 to 16:15 Toda: Curve counting and strong rationality conjecture**

Notes: I will introduce the strong rationality conjecture of the generating series of Donaldson–Thomas invariants proposed by Pandharipande–Thomas, and explain that it is equivalent to the multi covering formula of counting invariants of semistable one dimensional sheaves. Then I will give some cases where the multi covering formula is satisfied, hence strong rationality holds.

■ **16:15 to 17:00 Yamazaki: Crystal Melting and Wall Crossing Phenomena**

Notes: Motivated by recent mathematical developments in non-commutative Donaldson–Thomas theory, we construct a new statistical mechanical model of crystal melting to count BPS bound states of $D0$ and $D2$ branes on a single $D6$ brane wrapping an arbitrary toric Calabi–Yau threefold. We also discuss the wall crossing phenomena and the thermodynamic limit of the statistical mechanical model, which are crucial for the proper understanding of the relation between the crystal melting and the topological string theory.

Tuesday, 19 May

• Events

■ **09:45 to 11:45 Nakajima: Perverse coherent sheaves on blowup**

Notes: Consider a complex projective surface and its one point blowup. Moduli spaces of torsion free sheaves on two surfaces are related, but precise relation of various invariants, e.g., Euler numbers, Donaldson–type invariants are not obvious. We propose a new family of moduli spaces, parametrizing perverse coherent sheaves, connecting two moduli spaces by sequences of wall-crossings. Now change of invariants can be understood from the wall-crossing formula.

■ **13:00 to 15:00 Neitzke: BPS Wall-Crossing, Field Theory and Hyperkahler Geometry**

Notes: I will describe some recent joint work with Davide Gaiotto and Greg Moore, in which we explain the origin of the wall-crossing formula of Kontsevich and Soibelman, in the context of $N=2$ supersymmetric field theories in four dimensions. The wall-crossing formula gives a recipe for constructing the smooth hyperkahler metric on the moduli space of the field theory reduced on a circle to 3 dimensions. In certain examples this moduli space is actually a moduli space of ramified Higgs bundles, so we obtain a new description of the hyperkahler structure on that space.

■ **15:30 to 17:30 Verlinde: Wall Crossing, Borchers Algebras and a Farey Tail for $N=4$ Dyons**

Notes: I will review a counting formula for $N=4$ Dyon states in terms of an automorphic form. The automorphic form is given by the denominator formula associated with a Borchers algebra. Particular attention is given to the occurrence of poles in the automorphic form. These poles lead to a wall crossing phenomena, but in addition to an asymptotic "Farey Tail" expansion in terms of classical "saddle points".

Wednesday, 20 May

• Events

■ **09:45 to 11:45 Soibelman: Motivic Donaldson–Thomas invariants and wall-crossing formulas**

Notes: I am going to discuss our joint work with Maxim Kontsevich on the mathematical approach to the BPS state counting (both numerical and refined) based on the ideas of motivic integration

■ **13:00 to 15:00 Mikhalkin: Enumerative invariants in tropical geometry**

Notes: We will review some enumerative invariants in tropical geometry as well as their relation to the corresponding complex and real enumerative invariants.

■ **15:30 to 16:15 Cheng: Wall-crossing of $N=4$ dyons**

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16:15 to 17:00 Nagao: "Open" non-commutative Donaldson–Thomas invariants

Notes: For a small crepant resolution of a CY 3-fold, Donaldson–Thomas invariants and non-commutative Donaldson–Thomas invariants are related via wall-crossing. We can compute Donaldson–Thomas invariants of a toric CY 3-fold by the topological vertex, where we put empty Young diagrams on the torus fixed C^2 's. In this talk, using combinatorial descriptions, I am going to introduce analogs of non-commutative Donaldson–Thomas invariants corresponding to the topological vertex with Young diagrams on the torus fixed C^2 's and to provide "wall-crossing" formulas.

Thursday, 21 May

• Events

09:45 to 11:45 Maulik: Gromov–Witten theory of K3 surfaces

Notes: We will discuss the Gromov–Witten theory of K3 surfaces, in the case of counting rational curves and curves of higher genus. In the latter case, we explain a precise evaluation of certain Hodge integrals using the relation to stable pairs theory (joint with R. Pandharipande and R. Thomas).

13:00 to 15:00 Denef: Wall crossing and black holes: a review

Notes: I will give a basic review, for non-experts, of the physics of BPS states and in particular the appearance of black hole bound states, which leads to a simple physics derivation of many interesting wall crossing formulae.

15:30 to 16:15 Ookawa: Moduli on the projective plane and the wall crossing

Notes: We consider moduli spaces of semistable sheaves on the projective plane as moduli spaces of semistable representations of certain quiver with relations. In the case where rank is less than 3, we obtain the flips of the moduli spaces as wall crossing phenomena by changing theta stability of representations. By this description we compute Betti number of the flips.

16:15 to 17:00 Krefl: The real topological string

Notes: We will discuss several aspects of the real topological string, that is, the topological string on a background with O-plane and D-brane at its real locus, at hand of local P^2 : Especially, we will show how to refine localization on the moduli space of maps to compute open and unoriented Gromov–Witten invariants, how to reproduce the corresponding topological amplitudes in the topological vertex formalism and finally how the amplitudes can be derived via the extended holomorphic anomaly equations in the mirror B-model.

Friday, 22 May

• Events

09:45 to 11:45 Fukaya: A brane counting on Novikov ring

Notes: Mirror symmetry at the neighborhood of Maximal degenerate point works over a kind of formal power series ring called Novikov ring. Lagrangian Floer theory and GW theory in symplectic side works only over Novikov ring, so far, since convergence is very hard to prove.

I want to mention several points which is related how to count A brane (Lagrangian submanifold with well-defined and nontrivial Floer homology) in case everything is defined over Novikov ring. The story is rather solid in the case of Toric manifold and is conjectural in the case of Calabi–Yau 3 fold.

13:00 to 15:00 Hanany

15:30 to 16:15 Dimofte: Refined Wall Crossing

Notes: In string compactifications on toric Calabi–Yau manifolds one can introduce refined BPS invariants that carry information not only about the charge of the BPS state but also about the spin content. I will consider how these "refined" BPS invariants behave under wall crossing, and relate them to the motivic Donaldson–Thomas invariants of Kontsevich and Soibelman. I will also explain how refined wall crossing for the resolved conifold geometry can be realized in statistical crystal melting models.

16:15 to 17:00 Konishi: Local B-model and mixed Hodge structure

Notes: The mirror manifold of the canonical bundle of a smooth nef toric surface S is an open threefold Z defined by the data of the toric fan of S . We compute the mixed Hodge structure of Z and define an analogue of Griffiths–Yukawa coupling. This is a joint work with Satoshi Minabe.