Graduate Workshop on Geometry of Hilbert schemes Talk Schedule

Events for:
Monday, November 18th - Friday, November 22nd

Monday, November 18th

8:00am **Breakfast - SCGP Cafe**

9:00am **Robert Lazarsfeld - SCGP 102**

Title: Introduction to Hilbert schemes of smooth surfaces I

Abstract: TBA

10:30am **Coffee Break - SCGP Cafe**

11:00am **Alexander Kirillov - SCGP 102**

Title: Heisenberg algebra and Fock space

Abstract: TBA

12:30pm **Lunch - SCGP Cafe**

1:45pm **David Stapleton - SCGP 102**

Title: Picard Group and Ample Cone of Hilbert Scheme of Points on a Surface

Abstract: We will calculate the picard group of the hilbert scheme of points on a surface following Fogarty. We will then find the ample cone for the special case where our surface is P^2.

2:30pm **Short Break**

2:45pm **Ken Ascher - SCGP 102**

Title: Dynkin diagrams and McKay correspondence

Abstract: TBA

3:30pm **Tea Time - SCGP Cafe**

4:00pm **Xudong Zheng - SCGP 102**

Title: Punctual Hilbert scheme of points on surfaces

Abstract: The Hilbert scheme of points of smooth algebraic surfaces has been extensively studied. In this talk, I report my work in progress focusing on the Hilbert scheme of points on a surface with a rational double point, and particularly the punctual Hilbert scheme parametrizing closed subschemes which are entirely supported at the singular locus.

4:30pm **Chunyi Li - SCGP 102**

Title: An introduction to the deformation of Hilb P2

Abstract: The deformation of the Hilbert scheme of points on the projective plane is first constructed in the paper of Nevins and Stafford by an approach of non-commutative geometry. In 2011, Hitchin reintroduces the construction by an approach from Poisson geometry. In addition, he shows that the construction by Nevins and Stafford is `versal', i.e., all the deformations of the Hilbert scheme are constructed in their way. I will briefly introduce these constructions through an example of Hilb^2 P_2, and talk about my work/joint work on the deformation of Hilbert scheme of del Pezzo surface, as well as an interesting result on the minimal model program of the deformation of Hilb^n P_2.

Tuesday, November 19th

8:00am **Breakfast - SCGP Cafe**

9:00am **Robert Lazarsfeld - SCGP 102**

Title: Introduction to Hilbert schemes of smooth surfaces II

Abstract: TBA

10:30am **Coffee Break - SCGP Cafe**

11:00am **Mark de Cataldo - SCGP 102**

Title: Cohomology of Hilbert schemes

Abstract: TBA

12:30pm **Lunch - SCGP Cafe**

1:45pm **Zili Zhang - SCGP 102**

Title: An intersection number

Abstract: We will compute the intersection number between two cycles in Hilbert scheme of n points on smooth surface. One cycle represents subschemes whose support is of cardinality one, while the other cycle represents subschemes whose support is one given point. The computation is due to Geir Ellingsrud and Stein Arild Stromme.

2:30pm **Short Break**

2:45pm **Galyna Dobrovolska - SCGP 102**

Title: Simple and affine Lie algebras

Abstract: TBA

3:30pm **Tea Time - SCGP Cafe**

4:00pm **Eugene Gorsky - SCGP 102**

Title: Introduction to Hilbert schemes on singular curves

Abstract: Conjectures of Oblomkov, Rasmussen and Shende relate the geometry of the Hilbert schemes on singular planar curves to knot invariants. This relation provides new remarkable insights both for algebraic geometry and for knot theory. I will review the current status of the conjectures and formulate some open problems that may be accessible for graduate students.

Wednesday, November 20th

8:00am **Breakfast - SCGP Cafe**

9:00am **Mark de Cataldo - SCGP 102**

Title: The action of the Heisenberg algebra

Abstract: TBA

10:30am **Coffee Break - SCGP Cafe**

11:00am **Alexander Kirillov - SCGP 102**

Title: Geometric realization of affine Lie algebras

Abstract: TBA

12:30pm **Lunch - SCGP Cafe**

1:45pm **Daniele Boccalini - SCGP 102**

Title: Hilb T*C and Higgs bundles

Abstract: We will discuss analogies between the moduli space M of Higgs bundles over a curve C and the Hilbert scheme Hilb T*C of points on the cotangent bundle of the curve C. An Higgs field over a curve C is the data of a vector bundle and a twisted endomorphism of it. Taking the characteristic polynomial of the endomorphism gives a proper Lagrangian fibration of M, whose generic fiber is a Jacobian variety. This leads to a birational map from M to Hilb T*C. We will concentrate on the case where C is an elliptic curve. Here things are better behaved, and, taking into account a parabolic structure on the Higgs bundles, it is possible to extend the birational map to an actual isomorphism. This is achieved thanks to a Fourier-Mukai transform analysis. The talk is based on Nakajima's book and on an article of M. Groechenig.

2:30pm **Short Break**

2:45pm **Brooke Ullery - SCGP 102**

Title: Tautological bundles on the Hilbert scheme of points

Abstract: To each line bundle L on a smooth variety X, we can associate a vector bundle E_L on the Hilbert scheme of n points on that variety. This vector bundle is tautological in the sense that its fiber over a general point is the sum of the fibers of L over the points in the corresponding subscheme of X. As these vector bundles arise so naturally, they come up in many settings such as embeddings of the Hilbert scheme in Grassmannians and syzygies of line bundles on curves. We will carefully compute the cohomology of E_L and its determinant, and then discuss a few applications of these computations.

3:30pm **Tea Time - SCGP Cafe**

4:00pm **Eugene Gorsky - SCGP 102**

Title: Hilbert schemes of singular curves and Catalan numbers

Abstract: A conjecture of Oblomkov and Shende, recently proven by Maulik, relates the Hilbert schemes of points on a plane curve singularity to the invariants of the corresponding knots. I will describe the homology of these Hilbert schemes for singularities {x^n=y^m} corresponding to torus knots, and relate it to the bigraded deformation of Catalan numbers introduced by Garsia and Haiman. The talk is based on a joint work with M. Mazin.

4:30pm **Joachim Jelisiejew - SCGP 102**

Title: On the local geometry of Hilbert Schemes

Abstract: In the talk we examine the local geometry of the Hilbert Scheme of d points on $\mathbb{P}^n$. If $n > 2$ little is known about the dimension of this scheme and its local properties. After reviewing some classical results on connectedness and smoothness, we concentrate on irreducibility of the Hilbert Scheme and explore the rich interplay between the properties of the algebra corresponding to a point p of the Hilbert Scheme and the local geometry of this scheme near p. The related research was done during my MSc thesis. My advisor was J. Buczynski and I collaborated with Gf. Casnati and R. Notari.

5:30pm **Food Physics Event: Molecular Gastronomy Cooking Demo; Food Chemistry Talk - SCGP Gallery and 102**

Thursday, November 21st

8:00am **Breakfast - SCGP Cafe**

9:00am **Giulia Sacca - SCGP 102**

Title: Hilbert schemes and Hyperkahler manifolds

Abstract: TBA

10:30am **Coffee Break - SCGP Cafe**

11:00am **Izzet Coskun - SCGP 102**

Title: Interpolation and the birational geometry of the Hilbert scheme of points

Abstract: In this talk, I will introduce the interpolation problem for higher rank vector bundles and describe its relation to the birational geometry of Hilbert schemes of points. I will describe joint work with Jack Huizenga solving the interpolation problem for monomial schemes and general points of moduli spaces of sheaves.

12:30pm **Lunch - SCGP Cafe**

2:00pm **Matthew Woolf - SCGP 102**

Title: Gaeta Resolutions of Ideal Sheaves and Effective Divisors on Relative Jacobians

Abstract: In this talk, we will study the moduli space of pure one-dimensional sheaves on the projective plane, which is a compactification of the relative Jacobians of complete linear systems of plane curves. We will see how a close relationship between the Gaeta resolution of the generic ideal sheaf of n points and the minimal resolution of a generic pure one-dimesional sheaf makes it possible to translate work of Jack Huizenga on effective cones of Hilbert schemes into similar results for moduli spaces of one-dimensional sheaves.

2:30pm **Short Break**

2:45pm **Daniel Litt - SCGP 102**

Title: Motivic Analytic Number Theory

Abstract: There are beautiful and unexpected connections between algebraic topology, number theory, and algebraic geometry, arising from the study of the configuration space of (not necessarily distinct) points on a variety. In particular there is a relationship between the Dold-Thom theorem, the analytic class number formula, and the "motivic stabilization of symmetric powers" conjecture of Ravi Vakil and Melanie Wood. I'll discuss several ideas and open conjectures surrounding these connections, and describe the proof of one of these conjectures--a Hodge-theoretic obstruction to the stabilization of symmetric powers--in the case of curves and algebraic surfaces. Everything in the talk is defined from scratch, and should be quite accessible.

3:30pm **Tea Time - SCGP Cafe**

4:00pm **Math Colloquium: Aleksey Zinger - SCGP 102**

Title: Mirror Symmetry: an overview

Abstract: The mirror principle of string theory relates the symplectic topology of a Kahler manifold (counts of complex curves) to the differential geometry of its mirror family. Much of the current excitement about mirror symmetry stems from the 1991 paper of Candelas, de la Ossa, Green, and Parkes, which gave an explicit prediction for counts of rational curves in the quintic threefold. This has been followed by many predictions (and occasional verifications) for other types of curve counts. In this talk, I will touch on various flavors of mirror symmetry (``classical", real, and homological) and indicate the current state of affairs in the subject.

6:00pm **Workshop Banquet - SCGP Cafe**

Friday, November 22nd

8:00am **Breakfast - SCGP Cafe**

9:00am **Ivan Loseu - SCGP 102**

Title: Hilbert schemes, Procesi bundles and the n! conjecture I

Abstract: TBA

10:30am **Coffee Break - SCGP Cafe**

11:00am **Izzet Coskun - SCGP 102**

Title: Bridgeland stability and the birational geometry of the Hilbert scheme of points

Abstract: In this talk, I will introduce Bridgeland stability conditions on surfaces. I will then discuss how Bridgeland stability allows us to answer questions in the birational geometry of the moduli spaces of sheaves on surfaces. This talk will be based on joint work with Arcara, Bertram and Huizenga.

12:30pm **Lunch - SCGP Cafe**

1:45pm **Ivan Loseu - SCGP 102**

Title: Hilbert schemes, Procesi bundles and the n! conjecture II

Abstract: TBA

3:30pm **Tea Time - SCGP Cafe**