Schedule

Events for:
Monday, May 27th - Friday, May 31st

Monday, May 27th

9:30am **Sergei Gukov - SCGP 102**

Speaker: Sergei Gukov

Title: Quantization and (of) Hitchin Systems

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

11:00am **Sara Maloni - SCGP 102**

Speaker: Sara Maloni

Title: A crash course on quasi-Fuchsian manifolds

Abstract: Lecture 1-2: Hyperbolic space, Fuchsian and Quasi-Fuchsian manifolds and their convex cores In this mini-course I will discuss similarities and differences between quasi-Fuchsian manifolds in H^3, globally hyperbolic maximal compact manifolds in AdS^3 and an analog theory for representations in higher rank groups. I will try to underline open questions through all the lectures. In Lecture 1 and 2 I will focus on the hyperbolic case. After revising hyperbolic geometry, I will discuss the theory of Fuchsian and Kleinian groups, which are discrete subgroups of PSL(2,R) and of PSL(2,C) respectively, and their actions on H^2 and H^3. I will mostly focus on quasi-Fuchsian groups. These groups have been studied using complex analytic methods until the 70s when W. Thurston revolutionised the field introducing more topological methods. I will discuss Bers simultaneous uniformization theorem, whose proof uses complex analytic methods, and then I will discuss some of Thurston's theorems and conjectures about the convex cores of these hyperbolic manifolds. Lecture 3: Anti-de Sitter space, globally hyperbolic maximal compact manifolds and their convex cores. In Lecture 3 I will focus on the analog theory in anti-de Sitter space, which can be thought as a Lorentzian analog of hyperbolic space. First, I will recall the definition of the anti-de Sitter geometry and then I will define globally hyperbolic maximal compact manifolds, which are an analog of quasi-Fuchsian manifolds. I will then describe the analog of Bers and Thurston's theorems and conjectures, many of which are due to Mess. If I have time, I will discuss an analog picture for representations in Sp(4,C) which is joint work with D. Alessandrini and A. Wienhard. Another possibility would be to discuss a universal version of these results, joint work with F. Bonsante, J. Danciger and J.-M. Schlenker, in which we describe quasi-circles in the boundary of hyperbolic and anti-de Sitter space.

12:00pm **Lunch - SCGP Cafe**

1:20pm **Sergei Gukov - SCGP 102**

Speaker: Sergei Gukov

Title: Quantization and (of) Hitchin Systems

2:30pm **Peter Gothen - SCGP 102**

Speaker: Peter Gothen

Title: Examples of higher Teichmller components via G-Higgs bundles

Abstract: Some connected components of a moduli space are mundane in the sense that they are distinguished only by obvious topological invariants or have no special characteristics. Others, such as the Hitchin component in the moduli space of Higgs bundles, are more alluring and unusual either because they are not detected by primary invariants, or because they have special geometric significance, or both. In this talk we focus on the case when G is either SO(p,q) or some specific real forms of exceptional groups, and describe new examples of such "exotic" components in moduli spaces of G-Higgs bundles or, equivalently, moduli spaces of surface group representations into the Lie group G.

3:30pm **Coffee Break - SCGP Cafe**

4:00pm **Problem Session - SCGP 102**

Tuesday, May 28th

9:30am **Jonathan Heckman - SCGP 102**

Speaker: Jonathan Heckman

Title: Lectures on Geometric Engineering

Abstract: String Compactification

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

11:00am **Sara Maloni - SCGP 102**

Speaker: Sara Maloni

Title: A crash course on quasi-Fuchsian manifolds.

Abstract: Lecture 1-2: Hyperbolic space, Fuchsian and Quasi-Fuchsian manifolds and their convex cores. - Lecture 2: Anti-de Sitter space, globally hyperbolic maximal compact manifolds and their convex cores. In this mini-course I will discuss similarities and differences between quasi-Fuchsian manifolds in H^3, globally hyperbolic maximal compact manifolds in AdS^3 and an analog theory for representations in higher rank groups. I will try to underline open questions through all the lectures. In Lecture 1 and 2 I will focus on the hyperbolic case. After revising hyperbolic geometry, I will discuss the theory of Fuchsian and Kleinian groups, which are discrete subgroups of PSL(2,R) and of PSL(2,C) respectively, and their actions on H^2 and H^3. I will mostly focus on quasi-Fuchsian groups. These groups have been studied using complex analytic methods until the 70s when W. Thurston revolutionised the field introducing more topological methods. I will discuss Bers simultaneous uniformization theorem, whose proof uses complex analytic methods, and then I will discuss some of Thurston's theorems and conjectures about the convex cores of these hyperbolic manifolds.

12:00pm **Lunch - SCGP Cafe**

1:00pm **SCGP Weekly Talk: Joerg Teschner - SCGP 102**

    Title: Coordinates for Hitchin's moduli spaces, integrability, and topological strings

2:30pm **Antonella Grassi - SCGP 102**

    Speaker: Antonella Grassi

    Title: Singularities

3:30pm **Coffee Break - SCGP Cafe**

4:00pm **Problem Session - SCGP 102**

Wednesday, May 29th

9:30am **Jonathan Heckman - SCGP 103**

Speaker: Jonathan Heckman

Title: Lectures on Geometric Engineering

Abstract: Gauge Theory from Singular Geometry

10:30am Coffee Break - SCGP Cafe

11:00am Sara Maloni - SCGP 103

Speaker: Sara Maloni

Title: A crash course on quasi-Fuchsian manifolds.

Abstract: Analogs in higher Teichmuller theory and a universal point of view. In Lecture 3 I will focus on the analog theory in anti-de Sitter space, which can be thought as a Lorentzian analog of hyperbolic space. First, I will recall the definition of the anti-de Sitter geometry and then I will define globally hyperbolic maximal compact manifolds, which are an analog of quasi-Fuchsian manifolds. I will then describe the analog of Bers and Thurston's theorems and conjectures, many of which are due to Mess. If I have time, I will discuss an analog picture for representations in Sp(4,C) which is joint work with D. Alessandrini and A. Wienhard. Another possibility would be to discuss a universal version of these results, joint work with F. Bonsante, J. Danciger and J.-M. Schlenker, in which we describe quasi-circles in the boundary of hyperbolic and anti-de Sitter space.

12:00pm Lunch - SCGP Cafe

1:20pm Richard Wentworth - SCGP 103

Speaker: Richard Wentworth

Title: Conformal limits and Morse vs. Oper stratifications

Abstract: The notion of a conformal limit was introduced by Gaiotto to describe the behavior of solutions to the TBA equations under a certain scaling limit. In terms of moduli spaces, Gaiotto conjectured that the conformal limit provides a diffeomorphism between the Hitchin component in the Higgs moduli space and the space of opers in the de Rham moduli space. This conjecture was proven 2016 by Dumitrescu, et. al. The goal of these lectures will be to describe recent joint work with B. Collier in which we generalize this correspondence to give an identification of (nearly) the entire Morse and partial oper stratifications of the Hitchin and de Rham spaces. Along the way, I will give a complete proof of the existence of conformal limits for almost all Higgs bundles. References: 1. C. Simpson, "The Hodge filtration on nonabelian cohomology" arXiv:alg-geom/9604005 2. C. Simpson, "Iterated destabilizing modifications for vector bundles with connection" arXiv:0812.3472 3. D. Gaiotto, "Opers and TBA" arXiv:1403.6137 4. O. Dumitrescu, et.al. "Opers vs. Nonabelian Hodge" arXiv:1607.02172 5. I. Biswas, S. Heller, and M. Roeser, "Real holomorphic sections of the Deligne-Hitchin twistor space" arXiv:1802.06587 5. B. Collier and R. Wentworth, Conformal limits and the Bialynicki-Birula stratification of the space of ?-connections. (with Brian Collier). Adv. Math. 350 (2019) 1193-1225.

2:20pm **Short Break**

2:30pm **Giulia Sacca - SCGP 103**

Speaker: Giula Sacca

Title: The Hodge numbers of O'Grady's 10 dimensional hyperkahler manifold

Abstract: The Hodge numbers of the Hilbert scheme of points on a K3 surface and of generalized Kummer varieties (compact hyperkahler manifolds associated to an abelian surface) have been known for a while, thanks to Goettsche's formulae. In this talk I will sketch the ideas behind the computation of the Hodge numbers of the remaining known example of compact hyperkahler manifold, namely O'Grady's 10 dimensional example. The computation uses a refinement of Ngo's support theorem on some moduli spaces of sheaves on a K3 surface which have the structure of Lagrangian fibrations. This is joint work with M. A. de Cataldo and A. Rapagnetta.

3:30pm **Coffee Break - SCGP Cafe**

4:00pm **Problem Session - SCGP 103**

7:30pm **Banquet - Danford's Hotel & Marina, 25 E Broadway, Port Jefferson, NY 11777, USA**

Thursday, May 30th

9:30am **Jonathan Heckman - SCGP 103**

Speaker: Jonathan Heckman

Title: Lectures on Geometric Engineering

Abstract: Partially Twisted Gauge Theory and Local Manifolds of Special Holonomy

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

11:00am **Marina Logares - SCGP 103**

Speaker: Marina Logares

Title: TQFTs and Integrable systems: a geometric mystery.

Abstract: The non-abelian Hodge correspondence provides a diffeomorphism between the moduli spaces of representations of the fundamental group of a Riemann surface and the moduli space of Higgs bundles. While the latter space is provided with a fibration that makes it an algebraically completely integrable system, which plays a key role in Mirror Symmetry, the algebro-topological properties of the former allow us to define new TQFTs. We will overview these ideas while giving a general introduction to the field. This talk is based in various work with I. Biswas, A. González-Prieto, V. Muñoz, P. Newstead and A. Peón-Nieto.

12:00pm **Lunch - SCGP Cafe**

1:20pm **Richard Wentworth - SCGP 103**

Speaker: Richard Wentworth

Title: Conformal limits and Morse vs. Oper stratifications

Abstract: The notion of a conformal limit was introduced by Gaiotto to describe the behavior of solutions to the TBA equations under a certain scaling limit. In terms of moduli spaces, Gaiotto conjectured that the conformal limit provides a diffeomorphism between the Hitchin component in the Higgs moduli space and the space of opers in the de Rham moduli space. This conjecture was proven 2016 by Dumitrescu, et. al. The goal of these lectures will be to describe recent joint work with B. Collier in which we generalize this correspondence to give an identification of (nearly) the entire Morse and partial oper stratifications of the Hitchin and de Rham spaces. Along the way, I will give a complete proof of the existence of conformal limits for almost all Higgs bundles. References: 1. C. Simpson, "The Hodge filtration on nonabelian cohomology" arXiv:alg-geom/9604005 2. C. Simpson, "Iterated destabilizing modifications for vector bundles with connection" arXiv:0812.3472 3. D. Gaiotto, "Opers and TBA" arXiv:1403.6137 4. O. Dumitrescu, et.al. "Opers vs. Nonabelian Hodge" arXiv:1607.02172 5. I. Biswas, S. Heller, and M. Roeser, "Real holomorphic sections of the Deligne-Hitchin twistor space" arXiv:1802.06587 5. B. Collier and R. Wentworth, Conformal limits and the Bialynicki-Birula stratification of the space of ?-connections. (with Brian Collier). Adv. Math. 350 (2019) 1193-1225.

2:20pm **Short Break**

2:30pm **Ugo Bruzzo - SCGP 103**

Speaker: Ugo Bruzzo

Title: Curve semistable Higgs bundles

Abstract: We say that a Higgs bundle E over a projective variety X is curve semistable if for every morphism f: C —> X, where X is a curve, the pullback f*E is semistable. We study this class of Higgs bundles, reviewing the status of a conjecture about their Chern classes.

3:30pm **Coffee Break - SCGP Cafe**

4:00pm **Problem Session - SCGP 102**

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9:30am **Richard Wentworth - SCGP 103**

Speaker: Richard Wentworth

Title: Conformal limits and Morse vs. Oper stratifications

Abstract: The notion of a conformal limit was introduced by Gaiotto to describe the behavior of solutions to the TBA equations under a certain scaling limit. In terms of moduli spaces, Gaiotto conjectured that the conformal limit provides a diffeomorphism between the Hitchin component in the Higgs moduli space and the space of opers in the de Rham moduli space. This conjecture was proven 2016 by Dumitrescu, et. al. The goal of these lectures will be to describe recent joint work with B. Collier in which we generalize this correspondence to give an identification of (nearly) the entire Morse and partial oper stratifications of the Hitchin and de Rham spaces. Along the way, I will give a complete proof of the existence of conformal limits for almost all Higgs bundles. References: 1. C. Simpson, "The Hodge filtration on nonabelian cohomology" arXiv:alg-geom/9604005 2. C. Simpson, "Iterated destabilizing modifications for vector bundles with connection" arXiv:0812.3472 3. D. Gaiotto, "Opers and TBA" arXiv:1403.6137 4. O. Dumitrescu, et.al. "Opers vs. Nonabelian Hodge" arXiv:1607.02172 5. I. Biswas, S. Heller, and M. Roeser, "Real holomorphic sections of the Deligne-Hitchin twistor space" arXiv:1802.06587 5. B. Collier and R. Wentworth, Conformal limits and the Bialynicki-Birula stratification of the space of ?-connections. (with Brian Collier). Adv. Math. 350 (2019) 1193-1225.

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

10:50am **Jonathan Heckman - SCGP 102**

    Speaker: Jonathan Heckman

    Title: Lectures on Geometric Engineering

    Abstract: T-Branes

12:00pm **Washington Taylor - SCGP 102**

    Speaker: Washington Taylor

    Title: The Geometry and Physics of elliptic Calabi-Yau manifolds

1:00pm **Lunch - SCGP Cafe**

2:30pm **Hitchin Systems Program Seminar: Pietro Longhi - SCGP 102**

Speaker: Pietro Longhi

Title: Towards Enumerative Geometry with Exponential Networks

Abstract: Spectral networks compute certain enumerative invariants associated with Hitchin systems, by focusing on the interplay of certain geometric and combinatorial data within them. In physics, they count BPS states of class S theories through 2d-4d wall crossing. After reviewing the key ideas behind this framework both from a mathematical and physical viewpoint, I will introduce a 3d-5d uplift that captures generalized Donaldson-Thomas invariants of toric Calabi Yau threefolds. Time permitting, I will comment on connections to relativistic deformations of integrable systems, and the role of 3d tt* geometry, which appear as a counterpart of the Hitchin system in five dimensions. Joint work with Banerjee and Romo.