

Pacific Northwest Geometry Seminar: Fall 2022

Seattle University

Please direct questions about the venue to the local organizers:
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Welcome to Seattle University! **All talks in Bannan 401.** Lower density classroom available with streamed talks in Bannan 417. Feel free to use empty classrooms and spaces on the 4th and 5th floors.

SCHEDULE

Saturday November 5

8:45 am–9:15 am	Coffee and snacks near Bannan 401
9:15 am–10:15 am	Jackson Goodman
10:30 am– 11:30 am	Laura Frederickson
11:30 am – 1:30 pm	Lunch
1:30 pm–2:30 pm	Frederic Rochon
2:30 pm–3:30 pm	Coffee
3:00 pm–4:00 pm	Erin Griffin
4:15 pm–5:15 pm	Sebastien Picard

Sunday November 6

8:45 am–9:15 am	Coffee and snacks near Bannan 401.
9:15 am–10:15 am	Liz Stanhope
10:30 am– 11:30 am	Claude LeBrun

ABSTRACTS: SATURDAY NOVEMBER 5

- 9:15–10:15 am: Jackson Goodman (UC Berkeley)

New obstructions to positivity of curvature via twisted spinors

Abstract: We give new conditions on positivity of certain linear combinations of eigenvalues of the curvature operator of a Riemannian manifold which imply the vanishing of the indices of Dirac operators twisted with geometric vector bundles. The vanishing indices in turn have topological implications in terms of the Pontryagin classes, rational cobordism type, and Witten genus of the manifolds. To prove our results we generalize new methods developed by Peterson and Wink to apply the Bochner technique to Laplacians on geometric vector bundles.

- 10:30–11:30 am: Laura Frederickson (Oregon)

The asymptotic geometry of the Hitchin moduli space

Abstract: Hitchin's equations are a system of gauge theoretic equations on a Riemann surface that are of interest in many areas including representation theory, Teichmüller theory, and the geometric Langlands correspondence. The Hitchin moduli space carries a natural hyperkähler metric. An intricate conjectural description of its asymptotic structure appears in the work of Gaiotto-Moore-Neitzke and there has been a lot of progress on this recently. I will discuss some recent results using tools coming out of geometric analysis which are well-suited for verifying these extremely delicate conjectures. This strategy often stretches the limits of what can currently be done via geometric analysis, and simultaneously leads to new insights into these conjectures.

- 11:45–1:30 pm: Lunch.

Suggestions for restaurants near campus will be provided.

- 1:30–2:30 pm: Frédéric Rochon (UQÁM)

L^2 -cohomology of quasi-fibered boundary metrics

Abstract: Quasi-fibered boundary metrics (QFB metrics) form a class of complete metrics generalizing the class of quasi-asymptotically locally Euclidean metrics introduced by Joyce. After reviewing what QFB metrics are and presenting natural examples, we will present a new approach to compute the L^2 -cohomology of such metrics allowing to prove the Vafa-Witten conjecture and making advances on the Sen conjecture. This is based on a joint work with Chris Kottke.

- 3:00–4:00 pm: Erin Griffin (Seattle Pacific)

The Case for a General q -flow: An Investigation of Ambient Obstruction Solitons

Abstract: We will discuss a new program of studying solitons using a geometric flow for a general tensor q . We begin by establishing a number of results for solitons to the geometric flow for a general tensor, q , examining both the compact and non-compact cases. From there, we will apply these results to the ambient obstruction flow, the Bach flow ($n \geq 5$), and the Cotton flow to see the utility of this approach. We juxtapose this approach with a more hands-on approach used to show that any homogeneous gradient Bach soliton ($n = 4$) that is steady must be Bach flat; that the only homogeneous, non-Bach-flat, shrinking gradient solitons are product metrics on $\mathbb{R}^2 \times S^2$ and $\mathbb{R}^2 \times H^2$; and there is a homogeneous, non-Bach-flat, expanding gradient Bach soliton.

- 4:15–5:15 pm: Sebastien Picard (British Columbia)

Non-Kähler Transitions of Calabi-Yau Threefolds

Abstract: It was proposed in the works of Clemens, Reid and Friedman to connect Calabi-Yau threefolds with different topologies by a process which degenerates 2-cycles and introduces new 3-cycles. This operation may produce a non-Kähler complex manifold with trivial canonical bundle. In this talk, we will discuss the geometrization of this process by special non-Kähler metrics. This is joint work with T.C. Collins and S.-T. Yau.

- 6:30 pm–8:30 pm: Banquet at Tamarind Tree for those that selected this option during registration.

The venue is in Seattle's International District and 0.6 miles from the hotel and campus. Participants may walk, drive or take the Seattle Streetcar to this restaurant.

ABSTRACTS: SUNDAY NOVEMBER 6

- 9:15–10:15 am: Liz Stanhope (Lewis and Clark College)

Using Hodge spectra to detect orbifold singularities

Abstract: A Riemannian orbifold is a mildly singular generalization of a Riemannian manifold. A fundamental question in the Laplace spectral geometry of Riemannian orbifolds is whether or not a singular orbifold can be isospectral to a manifold. This question is open for the spectrum of the Laplacian acting on functions. We will see that combining information from the spectrum of the Laplacian on functions with information from the spectrum of the Hodge Laplacian on 1-forms will allow us to detect orbifold singularities in some cases. For example, a singular Riemannian orbifold

of dimension 3 or less cannot be both 0 and 1-isospectral to a Riemannian manifold. Our main tool is the list of heat invariants associated to the p -spectrum of the corresponding Hodge Laplacian.

- 10:30–11:30 am: Claude LeBrun (Stony Brook)

Curvature in the balance: The Weyl functional and scalar curvature of 4-manifolds

This talk will concern the Weyl functional on smooth compact 4-manifolds i.e. the Riemannian curvature functional which assigns, to each metric, the L^2 -norm-squared of its conformal curvature. On Kaehler metrics, the Weyl functional is expressible in terms of the L^2 -norm of the scalar curvature. However, the interaction between Weyl functional and the scalar curvature is far more subtle and indirect in the general Riemannian setting. The purpose of the talk will be to describe recent results and open questions regarding this relationship.