

Kyle Broder – Curriculum Vitae

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Academic Interests	Complex Differential Geometry; Riemannian Geometry; Several Complex Variables;
Present Academic Activities	My Ph.D. thesis – Vanishing theorems in Kähler and non-Kähler geometry – is being prepared under the supervision of Professor Benjamin Andrews (Australian National University) and Professor Gang Tian (Beijing University, Princeton University).
Brief Research Statement	Papers (1) and (2) address the algebraic structure of the Gromov–Hausdorff limits of collapsed limits of Ricci-flat Kähler metrics. This involves a technical use of the Schwarz lemma in the conical Kähler setting. In paper (3) I introduce the notions of the Schwarz bisectional curvature: This refines the real bisectional curvature introduced by Yang–Zheng and provides an optimal curvature constraint for the Schwarz lemma in the Hermitian setting. This paper also gives a unified approach to the various forms of the Schwarz lemma. This is expounded upon in paper (4), which is expository. The refined analysis of the real bisectional curvature carried out in papers (3) and (4) was applied to the Quadratic Orthogonal Bisectional Curvature (QOBC) – this produced papers (5)–(7). The analysis of the relationship between these curvatures, motivated by questions of projectivity, is given paper (8). A continuation of this program was carried in (9).
Education	<ul style="list-style-type: none">• (2015–2017). B. Sc. Australian National University.• (2018). B. Sc. (First Class Honours). Australian National University.• (Since November 2018). Ph.D. Australian National University and Peking University.
Articles and Preprints	<ol style="list-style-type: none">1. Twisted Kähler–Einstein Metrics and Collapsing arXiv:2003.14009 (submitted).2. Second-Order Estimates for collapsed limits of Ricci-flat Kähler metrics, arXiv:2106.13343 (submitted)3. The Schwarz Lemma in Kähler and Non-Kähler Geometry, arXiv:2109.06331 (submitted)4. The Schwarz Lemma: An Odyssey, arXiv:2110.04989 (submitted)5. On the Nonnegativity of the Dirichlet energy of a weighted graph, Bulletin of the Australian Mathematical Society, 1-5. doi:10.1017/S0004972721001015 (2021).6. An eigenvalue characterization of the dual EDM cone, Bulletin of the Australian Mathematical Society, DOI doi:10.1017/S0004972721000915 (2021).7. Remarks on the Quadratic Orthogonal Bisectional Curvature,8. (joint with Kai Tang). On the Weighted Orthogonal Ricci Curvature, arXiv:2111.00346 (submitted)9. (joint with Kai Tang). On the altered holomorphic curvatures of Hermitian manifolds, arXiv:2201.03666 (submitted)

10. (joint with Yanir Rubinstein). Curvature aspects of the hypothetical complex structure on the six-sphere (in preparation).
11. (joint with Simone Diverio). Remarks on the Wu–Yau theorem (in preparation).
12. (joint with Kai Tang and Yashan Zhang). (ε, δ) -quasi-negativity and positivity of the canonical bundle. (in preparation).
13. Complex manifolds which are not hyperbolic (in preparation).

Books

1. Lectures on Vector Calculus.

Journals Refereed for

- Advances in Mathematics

Teaching

I have been a tutor for the following courses:

- (2018 Semester 1, ANU). MATH1013 (Mathematics and Applications 1), teaching assistant.
- (2018 Semester 2, ANU). MATH1014 (Mathematics and Applications 2), teaching assistant.
- (2019 Semester 2, USYD). MATH1014 (Introduction to Linear Algebra), teaching assistant.
- (2020 Semester 1, USYD). MATH1021 (Calculus of one variable), teaching assistant.
- (2020 Semester 1, USYD). MATH2021 (Vector Calculus and Differential Equations), teaching assistant.
- (2020 Semester 2, USYD). MATH1023 (Multivariable Calculus and Modelling), teaching assistant.
- (2021 Semester 1, USYD). MATH1011 (Applications of Calculus), teaching assistant.
- (2021 Semester 1, USYD). MATH1111 (Introduction to Calculus), teaching assistant.
- (2021 Semester 1, USYD). MATH2021 (Vector Calculus and Differential Equations), teaching assistant.
- (2021 Semester 1, USYD). PHAR1821 (Pharmacy Practice 1), teaching assistant.
- (2021 Semester 2, USYD). MATH1023 (Multivariable Calculus and Modelling), teaching assistant.
- (2022 Semester 1, ANU). MATH2305 (Advanced Vector Calculus and Differential Equations), lecturer and course convenor.

Other Academic Activities

- In semester 2 of 2018 I helped organise a graduate reading group in complex differential geometry at the Australian National University.
- From November of 2018 to January 2019 I helped in the organisation of a graduate reading group in geometric measure theory at the Australian National University.
- Since January 2019 I have been an active participant in Professor Tian's bi-weekly student seminar.
- Since June of 2019 I have been an active participant in the University of Sydney Geometric Analysis Seminar.

- I have a math YouTube channel (with more than 4600 subscribers): <https://www.youtube.com/channel/UCkDicHMdLaJQ30Ily7B6wug>
- To help in the transition to online learning during the beginning of the pandemic, I was tasked by Jonathan Spreer to help tutors get acquainted with the *Ed forum*. This is an online forum that was used by the University of Sydney to facilitate communication between students, tutors, and lecturers.
- I have a bank of notes that I have written for various courses here: <https://github.com/Kylebroder/Teaching>

Research References

- **Benjamin Andrews**, the Australian National University.
Em: Ben.Andrews@anu.edu.au
- **Gang Tian**, Peking University, Beijing University.
Em: gtian@math.pku.edu.cn
- **Zhou Zhang**, University of Sydney.
Em: zhangou@maths.usyd.edu.au
- **Fangyang Zheng**, Chongqing Normal University
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Teaching Reference

- **Lilia Ferrario**, the Australian National University.
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