

WILLIE WAI-YEUNG WONG

Education

- 2009 Ph.D. in Mathematics, Princeton University, Princeton, NJ
Dissertation advisor: Sergiu Klainerman
Dissertation title: On the uniqueness of Kerr–Newman black holes
- 2005 B.A. with High Honors in Mathematics, Princeton University, Princeton, NJ

Research interests

- Lorentzian constant mean curvature flow:* the study of constant mean curvature Lorentzian hypersurfaces of Minkowski space from the point of view of the initial value problem (the constant mean curvature equations are hyperbolic PDEs). Main problems concern stability of exact/stationary solutions.
- Anisotropic second-order hyperbolic systems:* extension of the theory of isotropic hyperbolic systems (in particular nonlinear wave equations) to the setting without isotropy. Main problems right now are: robust linear decay estimates, small data global wellposedness of quasilinear systems, shock formation.
- Singularity formation and classification:* quantitative and qualitative descriptions of singularities, and notions of weak solutions for continuing past the singularity. Main problems include: construction of blow-up solutions to hyperbolic PDEs, stability of blow-up and threshold phenomenon, canonical weak evolution past singularities, geometry of the singular boundary.
- Geometric methods in hyperbolic PDEs and systems:* interplay of the characteristic geometry of hyperbolic systems and the qualitative behaviour of solutions, with focus on the quasilinear setting. Main problems include: decay estimates for the wave equation on curved backgrounds with trapping, low regularity local wellposedness of systems, Carleman estimates and unique continuation for systems.

Professional history

- 2015–present Assistant Professor
 Michigan State University, East Lansing, Michigan, USA
- 2011–2015 Post-doc collaborateur scientifique
 École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland
- 2009–2011 Postdoctoral research associate
 DPMMS, University of Cambridge, Cambridge, United Kingdom
- 2002, 2003 Energy Research Undergraduate Laboratory Fellow in atomic physics,
 Chemistry Division, Argonne National Laboratory, Argonne, Illinois, USA

Teaching experience*Instructor*

- MTH421 Analysis II / Michigan State University Fall 2015
- MTH299 Transitions / Michigan State University Fall 2015
- Mat202 Linear Algebra with Applications / Princeton University Spring 2008
 Taught one section of the course and then co-wrote and administered quizzes and exams.

Guest Instructor

- Partial Differential Equations / CCA, University of Cambridge October/November 2010
 Lectured on introduction to Sobolev spaces. Lecture notes available at <http://williewong.wordpress.com/notes-and-slides/>

Teaching Assistant

- Géométrie (GC) / École Polytechnique Fédérale de Lausanne Spring 2014
Head assistant: prepared and ran exercise sessions and examinations. Course covers basic differential geometry of curves and surfaces.
- Mathématiques Générales / University of Lausanne Fall 2013
Head assistant: performed organisational duties for the course as well as ran group exercise sessions. Course covers basic probability and statistics, and differential and integral calculus in one variable.
- Géométrie (EL/MX) / École Polytechnique Fédérale de Lausanne Spring 2013
Head assistant: prepared and ran exercise sessions and examinations. Course covers basic differential geometry of curves and surfaces.
- Mathématiques Générales / University of Lausanne Fall 2012
Ran group exercise sessions. Course covers basic probability and statistics, and differential and integral calculus in one variable.
- Part II Differential Geometry / University of Cambridge Lent term 2011
Ran supervisions (small group review sessions with two students each time).
- Mat451 Topics in Analysis: Introduction to General Relativity / Princeton University Spring 2009
Assigned and evaluated student work, and provided office hours.
- Mat433 Special Topics in Analysis / Princeton University Fall 2008
Evaluated student work and provided office hours.
- RTG Summer School in Analysis and Geometry / Princeton University Summers 2007, 2008
Taught afternoon recitations, ran problem sessions, and assigned and evaluated student work.
- Program in Analysis and General Relativity / Peking University, Beijing, China April 2007
Taught recitations and evaluated student work.

Honors and awards

- Phi Beta Kappa, inducted 2005
US National Science Foundation Graduate Research Fellowship, 2005-2008
International Physics Olympiad, Gold medal, 2001

Papers and preprints

- G Holzegel, S Klainerman, J Speck, and WWY Wong. "Shock Formation in Small-Data Solutions to 3D Quasilinear Wave Equations: An Overview". *To appear in J. Hyperbolic Diff. Eq.* (2014) arXiv: 1407.6276.
- WWY Wong. "Stability and instability of expanding solutions to the Lorentzian constant-positive-mean-curvature flow". *Submitted* (2014) arXiv: 1404.0223.
- R Donniger, J Krieger, J Szeftel, and WWY Wong. "Codimension one stability of the catenoid under the vanishing mean curvature flow in Minkowski space". *To appear in Duke Math Journal* (2013) arXiv: 1310.5606.
- WWY Wong. "A comment on the construction of the maximal globally hyperbolic Cauchy development". *J. Math. Physics* 54:113511 (2013) arXiv: 1310.1318.
- J Krieger and WWY Wong. "On type I blow up formation for the critical NLW". *Comm. PDE* 39:1718–1728 (2014) arXiv: 1301.4378.
- WWY Wong and P Yu. "Non-existence of multiple-black-hole solutions close to Kerr–Newman". *Comm. Math. Physics* 325:965–996 (2014) arXiv: 1210.1379.

- WWY Wong. “A positive mass theorem for two spatial dimension”. *Pre-print* (2012) arXiv: 1202.6279.
- WWY Wong. “Regular hyperbolicity, dominant energy condition and causality for Lagrangian theories of maps”. *Class. Quantum Grav.* 28:215008 (2011) arXiv: 1011.3029.
- GW Gibbons, CM Warnick, and WWY Wong. “Nonexistence of Skyrmion–Skyrmion and Skyrmion–anti-Skyrmion static equilibria”. *J. Math. Phys.* 52:012905 (2011) arXiv: 1005.2488.
- WWY Wong and P Yu. “On strong unique continuation of coupled Einstein metrics”. *Int. Math. Res. Notices* 2012:544–560 (2012) arXiv: 0904.0465.
- WWY Wong. “A space-time characterization of the Kerr–Newman metric”. *Ann. Henri Poincaré* 10:453–484 (2009) arXiv: 0807.1904.
- MT Huang, WWY Wong, M Inokuti, SH Southworth, and L Young. “Triple ionization of Lithium by electron impact”. *Phys. Rev. Lett.* 90:163201 (2003).

Conferences organized

- 76th Midwest Partial Differential Equations Seminar* co-organizer, East Lansing, Michigan. November 21–22, 2015. (with C. Sparber, K. Promislow, J. Schenker, R. Schwab, and J. Kitagawa.)
- Special session on the mathematical challenges of relativity* co-organizer, Joint Mathematics Meetings, San Francisco, California. January 13–16, 2010. (with P. Allen, M. Eichmair, G. Holzegel, and J. Speck)
- Mathematical challenges of general relativity* working group co-moderator, AMS Mathematical Research Communities program, Snowbird, Utah. June 13–19, 2009. (with G. Holzegel)

Seminars organized

- Analysis and PDE seminar* with J. Kitagawa, J. Schenker, R. Schwab, and A. Volberg, Michigan State University. 2015–present
- Geometric analysis and PDE seminar*, University of Cambridge. 2010–2011
- Mathematical GR student seminar* with J. Speck and V. Schlue, University of Cambridge. 2009–2011
- PDE study group*, Princeton University. 2007–2009

Service

- Referee for *Acta Applicanda Mathematicae*, *Annals of Physics*, *Communications in Mathematical Physics*, *Discrete and Continuous Dynamical System – A*, *Journal of Differential Geometry*, *Journal of Functional Analysis*, *Journal of Partial Differential Equations*, *Mathematical Research Letters*, *Notices of the American Mathematical Society*, *Proceedings of the American Mathematical Society*, *Proceedings of the Royal Society A*, *Selecta Mathematica*, and *Surveys in Differential Geometry*.
- Regular contributor to *Mathematical Reviews/MathSciNet*.
- Regular contributor to MathOverflow (<http://mathoverflow.net>).
- Moderator for the Mathematics Stack Exchange (<http://math.stackexchange.com/>) discussion forum. 2010–2014

Professional organization

- American Association for the Advancement of Science, through the AAAS/Science Program for Excellence in Science, 2009–2011
- American Mathematical Society, 2005–present
- Sigma Xi, 2005–present

Invited talks

- Job candidate talk*, Georgia Institute of Technology, Atlanta, Georgia, USA. February 10, 2015.
- Analysis seminar*, Princeton University, Princeton, New Jersey, USA. February 9, 2015.
- Mathematics colloquium (job candidate talk)*, Michigan State University, East Lansing, Michigan, USA. January 20, 2015.
- Mathematics colloquium (job candidate talk)*, University of California Santa Barbara, Santa Barbara, California, USA. November 25, 2014.
- Christodoulou/Eichmair informal relativity seminar*, ETHZ, Zurich, Switzerland. November 13, 2014.
- Geometric analysis and PDE seminar*, University of Cambridge, Cambridge, United Kingdom. November 3, 2014.
- Analysis seminar*, EPFL, Lausanne, Switzerland. April 11, 2014.
- Mini-course for the *OXPDE Workshop on Nonlinear Wave Equations and General Relativity*, University of Oxford, Oxford, United Kingdom. January 13 & 14, 2014. (with G. Holzegel)
- OXPDE seminar*, University of Oxford, Oxford, United Kingdom. November 11, 2013
- Seminar as part of the *Mathematical General Relativity* semester program, MSRI, Berkeley, California, USA. September 5, 2013
- Geometry and analysis seminar*, Imperial College London, London, United Kingdom. March 21, 2013
- Gravitational physics seminar*, University of Vienna, Vienna, Austria. December 5, 2012
- Partial differential equations seminar*, EPFL, Lausanne, Switzerland. April 1, 2011
- Mathematical general relativity seminar*, LJLL, Université Pierre et Marie Curie, Paris, France. March 21, 2011
- Analysis seminar*, University of Birmingham, Birmingham, United Kingdom. March 2, 2011
- Analysis seminar*, University of Edinburgh, Edinburgh, United Kingdom. February 7, 2011
- Mathematical physics seminar*, University of Cambridge, Cambridge, United Kingdom. February 1, 2011
- Geometric analysis and PDE seminar*, University of Cambridge, Cambridge, United Kingdom. November 29, 2010
- Mathematical Relativity Workshop*, ICMS, Edinburgh, United Kingdom. September 2, 2010
- Relativity and cosmology seminar*, Queen Mary University of London, London, United Kingdom. May 12, 2010
- Relativity seminar*, University of Oxford, Oxford, United Kingdom. March 9, 2010
- Special session on general relativity and related partial differential equations*, AMS Fall Southeastern Meeting, Florida Atlantic University, Boca Raton, Florida. October 30, 2009