

## Biographical Sketch of Motohico Mulase

### Current Positions and Affiliation.

- Distinguished Professor of Mathematics, UC Davis
- Senior Scientist, Kavli Institute for the Physics and Mathematics of the Universe, the University of Tokyo, Japan

### Professional Preparation.

- University of Tokyo: B.S. in Mathematics, 1978.
- Research Institute for Mathematical Sciences, Kyoto University: Graduate Degree equivalent to U.S. Ph.D. in Mathematics, 1980. Thesis Advisors: Mikio Sato and Heisuke Hironaka.
- Kyoto University: Doctor of Science (D.Sc.), 1985. Thesis Advisors: Mikio Sato and Masaki Kashiwara.

### Positions Held.

- UC Davis Distinguished Professor, 2019–.
- Associate Dean of the Faculty for Mathematical and Physical Science, UC Davis, 2017–2019.
- Senior Scientist, Kavli Institute for the Physics and Mathematics of the Universe, 2013–.
- Chair, Department of Mathematics, UC Davis, 1998–2001, 2004–2007.
- Professor of Mathematics, UC Davis, 1991–.
- Member, Max-Planck-Institut für Mathematik, Bonn, Germany, 1991–92.
- Associate Professor of Mathematics, UC Davis, 1989–91.
- Member, The Institute for Advanced Study, Princeton, 1988–89.
- E. R. Hedrick Assistant Professor, UCLA, 1985–88.
- Visiting Assistant Professor, Stony Brook University, 1984–85.
- Member, Mathematical Sciences Research Institute, Berkeley, 1982–84.
- Research Assistant Professor, Nagoya University, 1980–82.

### Short-Term Visiting Professorship.

- Simons Center for Geometry and Physics, 2015, 2016, 2019, 2022.
- Max-Planck-Institut für Mathematik, Bonn, 2011, 2013, 2014, 2015, 2016, 2019, 2020.
- National Tsing Hua University, Hsinchu, Taiwan, 2019.
- Beijing International Center for Mathematical Research, Peking University, 2018.
- Institute for Basic Science, Center for Geometry, Pohang, Korea, 2017.
- Institut Henri Poincaré, Paris, 2016, 2017.
- Université Pierre et Marie Curie (Université Paris VI), 2015, 2017.
- Institut des Hautes Études Scientifiques, Bures-sur-Yvette, France, 2013, 2017.
- Osaka City University Advanced Mathematical Institute, 2015, 2016.
- University of Melbourne, 2013, 2016.
- Hong Kong University of Science and Technology, 2015.
- Korteweg-de Vries Institute, University of Amsterdam, 2011, 2012, 2013, 2014, 2015.
- Kobe University, 2012, 2014.
- Center for Quantum Geometry of Moduli Spaces, Aarhus University, 2013.
- Instituto Superior Técnico, Lisbon, 2013.
- Kavli Institute for the Physics and Mathematics of the Universe, University of Tokyo, 2012.
- University of Salamanca, Spain, 2008, 2009, 2011.
- Tsinghua University, Beijing, 2010.
- Universiti Teknologi Malaysia, 2010.
- Humboldt-Universität zu Berlin, Germany, 1995, 1996, 2002, 2009.
- Korea Institute for Advanced Study, 2008.
- Kyoto University, 1993, 1994, 1995, 2008.
- Nagoya University, 2003, 2005.

**Honors.**

- JMS Fellowship, Harvard University, 1982–83.
- RIMS International Project Research Visiting Professorship, Kyoto University, 2008.
- UC Davis Academic Senate Distinguished Teaching Award, 2009.
- Simons Visiting Professorship, Mathematisches Forschungsinstitut Oberwolfach, 2016.
- UC Davis Distinguished Professor of Mathematics, 2019.

**Book Edited.**

- Chiu-Chu Melissa Liu and Motohico Mulase, Editors, *Topological Recursion and its Influence in Analysis, Geometry, and Topology*, Proceedings of Symposia in Pure Mathematics **100**, 549 pps, American Mathematical Society, 2018. [ISBN: 978-1-4704-3541-7]

**Selected Publications.**

- (1) Motohico Mulase *Complete integrability of the Kadomtsev-Petviashvili equation*, Advances in Mathematics **54**, 57–66 (1984).
- (2) Motohico Mulase, *Cohomological structure in soliton equations and Jacobian varieties*, Journal of Differential Geometry **19**, 403–430 (1984).
- (3) Motohico Mulase, *Solvability of the super KP equation and a generalization of the Birkhoff decomposition*, Inventiones Mathematicae **92**, 1–46 (1988).
- (4) Motohico Mulase, *Category of vector bundles on algebraic curves and infinite dimensional Grassmannians*, International Journal of Mathematics **1**, 293–342 (1990).
- (5) Motohico Mulase, *A new super KP system and a characterization of the Jacobians of arbitrary algebraic super curves*, Journal of Differential Geometry **34**, 651–680 (1991).
- (6) Motohico Mulase, *Algebraic theory of the KP equations*, Perspectives in mathematical physics **3**, 151–217 (1994).
- (7) Motohico Mulase and Yingchen Li, *Prym varieties and integrable systems*, Communications in Analysis and Geometry **5**, 279–332 (1997).
- (8) Motohico Mulase and Michael Penkava, *Ribbon Graphs, Quadratic Differentials on Riemann Surfaces, and Algebraic Curves Defined over  $\overline{\mathbb{Q}}$* , Asian Journal of Mathematics **2** (4), 875–920 (1998).
- (9) Motohico Mulase and Andrew Waldron, *Duality of orthogonal and symplectic matrix integrals and quaternionic Feynman graphs*, Communications in Mathematical Physics **240** (3), 553–586 (2003).
- (10) Motohico Mulase and Brad Safnuk, *Mirzakhani’s recursion relations, Virasoro constraints and the KdV hierarchy*, Indian Journal of Mathematics **50** (1), 189–228 (2008).
- (11) Motohico Mulase and Naizhen Zhang, *Polynomial recursion formula for linear Hodge integrals*, Communications in Number Theory and Physics **4**, 267–294 (2010).
- (12) Bertrand Eynard, Motohico Mulase and Brad Safnuk, *The Laplace transform of the cut-and-join equation and the Bouchard-Mariño conjecture on Hurwitz numbers*, Publications of the Research Institute for Mathematical Sciences **47**, 629–670 (2011).
- (13) Motohico Mulase and Michael Penkava, *Topological recursion for the Poincaré polynomial of the combinatorial moduli space of curves*, Advances in Mathematics **230**, 1322–1339 (2012).
- (14) Olivia Dumitrescu, Motohico Mulase, Brad Safnuk, and Adam Sorkin, *The spectral curve of the Eynard-Orantin recursion via the Laplace transform*, Contemporary Mathematics **593**, 263–315 (2013).
- (15) Motohico Mulase, Sergey Shadrin and Loek Spitz, *The spectral curve and the Schrödinger equation of double Hurwitz numbers and higher spin structures*, Communications in Number Theory and Physics **7** (1), 125–143 (2013).
- (16) Vincent Bouchard, Daniel Hernández Serrano, Xiaojun Liu, and Motohico Mulase, *Mirror symmetry for orbifold Hurwitz numbers*, Journal of Differential Geometry **98**, 375–423 (2014).
- (17) Olivia Dumitrescu and Motohico Mulase, *Quantum curves for Hitchin fibrations and the Eynard-Orantin theory*, Letters in Mathematical Physics **104**, 635–671 (2014).

- (18) Motohico Mulase and Piotr Sułkowski, *Spectral curves and the Schrödinger equations for the Eynard-Orantin recursion*, *Advances in Theoretical and Mathematical Physics* **19**, 955–1015 (2015).
- (19) Petr Dunin-Barkowski, Motohico Mulase, Paul Norbury, Alexandr Popolitov, and Sergey Shadrin, *Quantum spectral curve for the Gromov-Witten theory of the complex projective line*, *Journal für die reine und angewandte Mathematik* **2017-726**, 267–289 (2017).
- (20) Olivia Dumitrescu, Laura Fredrickson, Georgios Kydonakis, Rafe Mazzeo, Motohico Mulase, and Andrew Neitzke, *From the Hitchin section toopers through nonabelian Hodge*, *Journal of Differential Geometry* **117** (2), 223–253 (2021).
- (21) Olivia Dumitrescu and Motohico Mulase, *Interplay between opers, quantum curves, WKB analysis, and Higgs bundles*, *SIGMA* **17**, **036**, 53 pages (2021).

#### **Selected Conference Organizations.**

- (1) Institute for the Physics and Mathematics of the Universe Workshop “*A New Recursion from Random Matrices and Topological String Theory*,” December 2008, Kashiwa, Japan.
- (2) The 16th Osaka City University International Academic Symposium “*Riemann Surfaces, Harmonic Maps and Visualization*,” December 2008m Osaka, Japan.
- (3) American Institute of Mathematics Workshop “*Recursion structures in topological string theory and enumerative geometry*,” June 2009, Palo Alto, California.
- (4) UC Davis-MSRI Conference “*Algebra and Topology in Interaction*,” September 2009, UC Davis.
- (5) American Institute of Mathematics SQuaRE “*Geometry and Physics of the New Topological Recursion*,” May 3–7, 2010, Palo Alto, California.
- (6) Banff International Research Station Workshop: “*New Recursion Formulae and Integrability for Calabi-Yau Spaces*,” October 16–October 21, 2011, Banff, Canada
- (7) Banff International Research Station Workshop: “*Quantum Curves and Quantum Knot Invariants*,” June 15–June 20, 2014, Banff, Canada
- (8) American Institute of Mathematics Workshop: “*Quantum curves, Hitchin systems, and new developments in the Eynard-Orantin theory*,” September 28–October 3, 2014, Palo Alto, California
- (9) OCU Workshop: “*Quantization of Spectral Curves*,” November 2–6, 2015, at the Osaka City University Advanced Mathematical Institute, Osaka, Japan
- (10) 2016 AMS von Neumann Symposium: “*Topological Recursion and its Influence in Analysis, Geometry, and Topology*,” July 4–8, 2016, at Hilton Charlotte University Place, NC
- (11) 2016 MATRIX Program: “*Interactions between topological recursion, modularity, quantum invariants and low-dimensional topology*,” Nov. 28–Dec. 23, 2016, Creswick, Australia
- (12) Banff International Research Station Workshop 18w5078: “*Geometry and Physics of Quantum Curves*,” September 9–14, 2018, in Banff, Canada

#### **Invited Talks at Conferences, Workshops, and Research Institutes (last 10 years).**

- (1) Moduli of Chestnut Hill, Boston College, March 5–7, 2020.
- (2) Spring Emphasis Semester 2020: Workshop on Topological and Geometric Recursion, Institute of the Mathematical Sciences of the Americas, University of Miami, February, 2020.
- (3) GRK 1670 Workshop: BPS states, topological recursion, exact WKB and abelianisation, DESY, University of Hamburg, November 25–28, 2019.
- (4) Kavli IPMU Seminar: Mathematics–String Theory, Kavli Institute for the Physics and Mathematics of the Universe, University of Tokyo, September 17, 2019.
- (5) GEOQUANT 2019: International School and Conference on Geometry and Quantization, National Tsing Hua University, Hsinchu, Taiwan, September 4–6, 2019.
- (6) MPIM Seminar: Algebra, Geometry, and Physics, Max-Planck-Institut für Mathematik, Bonn, August 27, 2019.
- (7) Conference: Current trends in Hitchin systems, Universidad de Buenos Aires, Argentina, December 17, 2018.
- (8) RIMS Conference: D-modules, quantum geometry, and related topics, Research Institute for Mathematical Sciences Conference, Kyoto University, December 3, 2018.

- (9) The Eighth BICMR Advanced Seminar: Symplectic Geometry and Topological Field Theory, Beijing International Center for Mathematical Research, Peking University, October 2018.
- (10) 2018 ERC Conference: Quantum Fields, Knots, and Strings, University of Warsaw, Poland, September 2018.
- (11) 2018 Summer School of the TRR 195 and the Graduiertenkolleg Experimental and constructive algebra: Topological Recursion, University of Tübingen, August 2018.
- (12) 2018 Les Diablerets Winter School in Mathematical Physics, Les Diablerets, Switzerland, January 2018.
- (13) Institute for Basic Science Center for Geometry and Physics Intensive Lecture Series, Pohang, Korea, September 2017.
- (14) IHÉS Conference: Algebraic Analysis in Honor of Masaki Kashiwara's 70th Birthday, Institut des Hautes Études Scientifiques, Bures-sur-Yvette, June 6, 2017.
- (15) LJAD Conference: Higgs Bundles and Related Topics, Laboratoire J.A. Dieudonné, Nice, May 31, 2017.
- (16) IST Austria: Algebraic Geometry Seminar, Institute of Science and Technology, Austria, March 22, 2017.
- (17) IHP Workshop: "Enumerative Geometry and Combinatorics of Moduli Spaces," Institut Henri Poincaré, Paris, March 15, 2017.
- (18) QUANTMOD: Quantization and Moduli Spaces, Université du Luxembourg, January 2017.
- (19) MATRIX Conference: "Topological recursion and modularity," MATRIX, Creswick, Australia, December 22, 2016.
- (20) Kobe 2016 International Conference: "Algebraic Geometry and Integrable Systems," Kobe University, Japan, December 8, 2016.
- (21) The 15th Oka Symposium, Oka Mathematical Institute, Nara, Japan, December 4, 2016.
- (22) BIRS Workshop: "Painlevé Equations and Discrete Dynamics," Banff International Research Station, Banff, Canada, October 4, 2016.
- (23) RIMS Workshop: "Studies on Integrable Systems: State of the Art and Perspective for Future," Research Institute for Mathematical Sciences, Kyoto University, September 6, 2016.
- (24) OCAMI Meeting: "Integrable Systems, Moduli Spaces and Non-linear PDE," Osaka City University Advanced Mathematical Institute, Osaka, September 3, 2016.
- (25) Infinite Analysis 2016 Summer School: "Integrable Hierarchies and Beyond," Graduate School of Mathematics, Nagoya University, August 30, 31, September 1, 2016.
- (26) SCGP Workshop: "New perspectives on Higgs bundles, branes and quantization," Simons Center for Geometry and Physics, Stony Brook, June 17, 2016.
- (27) ICTS-TIFR Conference: "Higgs Bundles," International Center for Theoretical Sciences, Tata Institute of Fundamental Research Bangalore, India, March 23, 2016.
- (28) IMAR Lecture: Algebraic Geometry, Institute de Matematica "Simion Stoilow" al Academiei Romane, Bucharest, Romania, February 25, 2016.
- (29) MFO Workshop: "Topological Recursion and TQFTs," Mathematisches Forschungsinstitut Oberwolfach, Germany, February 14, 2016.
- (30) University of Luxembourg: RMATH General Mathematics Seminar, February 9, 2016.
- (31) Warsaw Advanced School: "Topological Quantum Field Theory," Faculty of Physics, University of Warsaw, Poland, December 7–10, 2015.
- (32) OCU Workshop: "Quantization of Spectral Curves," Osaka City University Advanced Mathematical Institute, Osaka, Japan, November 4, 2015.
- (33) GEOQUANT 2015: "School and International Conference on Geometry and Quantization," Instituto de Ciencias Matemáticas (ICMAT), Madrid, Spain, September 14, 2015.
- (34) MPIM-Bonn: "Mathematische Arbeitstagung 2015," Max-Planck-Institut für Mathematik, Bonn, Germany, June 27, 29, 2015.
- (35) Kolloquium des Graduiertenkollegs 1463: "Analysis, Geometrie und Stringtheorie," Leibniz Universität, Hannover, Germany, June 8, 2015.
- (36) Lorentz Center Workshop: "Geometric Invariants and Spectral Curves," Lorentz Center, Leiden, the Netherlands, June 5, 2015.

- (37) SCGP Program: “Knot homologies, BPS states, and SUSY gauge theories,” Simons Center for Geometry and Physics, May 14, 2015.
- (38) HKUST Seminars on Geometry, Hong Kong University of Science and Technology, March 24 - April 20, 2015.
- (39) Western Algebraic Geometry Symposium Spring 2015, University of California, Davis, March 1, 2015.
- (40) MPIM Workshop: “Geometric quantization and topological recursion,” Max-Planck-Institut für Mathematik, Bonn, November, 2014.
- (41) EIMI International Conference: “Embedded Graphs,” Euler International Mathematical Institute, St. Petersburg, Russia, October 2014.
- (42) AIM Workshop: “Quantum curves, Hitchin systems, and the Eynard-Orantin theory,” American Institute of Mathematics, Palo Alto, California, September 2014.
- (43) Advanced Summer School: “Modern Trends in Gromov-Witten Theory,” Leibniz Universität Hannover, September 2014.
- (44) Kobe Summer School: Advanced Science and Technology Graduate Course 2014, Kobe University, July 2014.
- (45) IMS Summer Research Institute: “The Geometry, Topology and Physics of Moduli Spaces of Higgs Bundles,” Institute for Mathematical Sciences, National University of Singapore, July 2014.
- (46) International Conference: “The Mathematics of Quantum Theory in Honor of Professor Albert Schwarz at his 80th Birthday,” UC Davis, California, May 2014.
- (47) MPIM Seminar on Algebra, Geometry and Physics, Max-Planck-Institut für Mathematik, Bonn, May 2014.
- (48) Mathematical Institute Geometry and Analysis Seminar, Mathematical Institute, University of Oxford, May 2014.
- (49) Conference on Mirror Symmetry and Spin Curves, Palazzone di Cortona, Italy, April 2014.
- (50) SMS Spring Conference on Quantization of Moduli Spaces, Villa Battelle, University of Geneva, April 2014.
- (51) Workshop on Moduli of curves and mathematical physics, Korteweg-de Vries Institute, Amsterdam, the Netherlands, January 2014.
- (52) Séminaire de Mathématiques (organisé par Mikhail Gromov, Laurent Lafforgue, Maxim Kontsevich), IHÉS, Bures-sur-Yvette, France, November 2013.
- (53) SISSA Workshop: “Hamiltonian PDEs, Frobenius Manifolds, and Deligne-Mumford Moduli Spaces,” La Scuola Internazionale Superiore di Studi Avanzati, Trieste, September 2013.
- (54) BIRS Workshop on Integrable Systems and Moduli Spaces (13w5064), Banff International Research Station, Canada, August 2013.
- (55) 5th IST Lectures on Algebraic Geometry and Physics, Instituto Superior Técnico, Lisbon, Portugal, February 2013.
- (56) QGM Conference on Topological recursion and quantum algebraic geometry, Center for Quantum Geometry of Moduli Spaces, Aarhus University, Denmark, January-February 2013.
- (57) BIRS Workshop on Integrable systems, growth processes and KPZ universality (12w5015), Banff International Research Station, Canada, September 2012.
- (58) XXXI Workshop on Geometric Methods in Physics, Białowieża, Poland, June 2012.
- (59) BICMR Conference on Symplectic Geometry and Mathematical Physics, The Beijing International Center for Mathematical Research, Beijing, June 2012.
- (60) The Hausdorff Research Institute for Mathematics Workshop: “Integrability in Topological String Theory,” The Hausdorff Research Institute for Mathematics, Bonn, April 2012.
- (61) The Fourier Institute Conference on Gromov-Witten Theory, The Fourier Institute, Grenoble, July 2011.
- (62) The Fourier Institute Summer School on Moduli of Curves and Gromov-Witten Theory, Fourier Institute, Grenoble, June 2011.
- (63) BIRS Workshop on Number Theory and Physics at the Crossroads, Banff International Research Station, May 2011.