

Curriculum Vitae of Tommaso Pacini

Submitted to the University of Milano for a PO professorship, 01/A2-MAT/03

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Part 1: General info

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Citizenship: Italy/USA (dual).

Current position:

Associate Professor, University of Torino, 2016-present.

Note: Italian habilitation as associate professor (2014) and full professor (2020).

Past positions:

- Professore aggregato, Scuola Normale Superiore (Pisa), 2012-2013 and 2015-2016.
- Ricercatore, Scuola Normale Superiore, 2009-2016 (tenured position).
- EIF Marie Curie Research Fellow, University of Oxford, 2007-2009.
- EPSRC Research Fellow, Imperial College (London), 2006-2007.
- VIGRE Visiting Assistant Professor, Georgia Institute of Technology (GT), 2003-2006.

Education:

- Ph.D. in Mathematics, Univ. of Pisa, 2002.

Advisors: Gang Tian (MIT), Paolo de Bartolomeis (Univ. of Florence).

Thesis title: *Flows and deformations of Lagrangian submanifolds in Kaehler-Einstein Geometry.*

- Laurea (equivalent to M.S.) in Mathematics, Univ. of Florence, 1996.

Pacini, CV Part 2: Grants and fellowships

Major grants:

- Marie Curie ERG “reintegration grant” at Scuola Normale Superiore, 2010-2013: research funds.
- Marie Curie EIF at Univ. of Oxford, 2007-2009: salary plus research funds.
- Grant (PI) at Scuola Normale Superiore for project “Analytic aspects of totally real geometry”, 2016-2018: research funds.

Note: Both Marie Curie grants above are project-specific. They are awarded by the Scientific Direction of the European Union after an extensive referee process. The third grant above was awarded by the Scuola Normale Superiore based on the evaluation of 2 external referees.

Other grants and fellowships:

- Research grant FFABR from the Italian Ministry of Ed. and Research (MIUR), 2017.
- Participant in PRIN 2017, 2020, 2022, financed by MIUR, headed by F. Bracci.
- Participant in PRIN 2010/2011 and 2013-16 headed by F. Ricci.
- Participant in ERC Advanced grant 2009, headed by L. Ambrosio.
- Research Affiliate (with stipend), MIT, 2003 (3 months).
- EU EAGER fellowship, Imperial College, 2002 (7 months).
- Additional graduate funds to work at MIT as visiting student, 1999-2001.
- Undergraduate grant to study at Courant Institute (NYU), 1995 (Fall semester).

Note: Also EPSRC and VIGRE fellowships (see “recent appointments”, above), SNS research funds (with Carlo Mantegazza and Lorenzo Mazzieri, 2011-2013, 2013-2015), UniTo research funds (with L. Vezzoni, 2016-2018, with A. Fino 2018-2020 and as PI, 2020-2022).

PACINI, CV Part 3: Research interests

My general field of research is Differential Geometry. I am currently interested in the following topics:

1) G2 geometry:

I use analogies with Kahler geometry as a guideline for new research directions in G2 geometry. In this context I am specifically interested in stability conditions for minimal submanifolds, in pluripotential theory, and in the development of a notion of G2-positivity for differential forms. Work in progress includes:

- Geometric properties of coassociative submanifolds (joint with A. Raffero).
- G2 geometry and positivity (joint with A. Raffero).
- Pluripotential theory, submersions and fibrations.

2) Complex geometry:

I have been working for several years on developing a geometry specific to totally real submanifolds. My current interest is in applying these results to define new holomorphic invariants for the ambient manifold. Work in progress includes:

- New holomorphic invariants for complex tori (based on the thesis project of M. Morbello, currently at Rennes).

3) Gauge theory:

I am interested in developing mirror-symmetric analogues of the totally real geometry and the holomorphic invariants discussed above.

4) Geometric analysis:

I am interested in the construction and deformations of calibrated submanifolds. Work in progress includes:

- Construction of special Lagrangian pairs of pants (joint with D. Matessi, Univ. of Milano).

Other interests:

- Geometry of submanifolds; calibrated geometry; construction of manifolds with special holonomy.
- Geometric analysis: Deformations and moduli spaces of calibrated submanifolds; desingularization procedures; gluing techniques; geometric flows.
- Geometric PDE: Geometric techniques in Optimal Transport; Hamiltonian PDE.

Collaborators:

Current: Alberto Raffero (Univ. of Torino), Diego Matessi (Univ. of Milano).

Past: Alessio Corti (Imperial College), Mark Haskins (Duke Univ.), Wilfrid Gangbo (UCLA), Hwa Kil Kim (Hannam Univ.), Jason Lotay (Univ. Oxford), Johannes Nordstrom (Univ. Bath).

Pacini, CV Part 4: Publications

- 16) Pacini, “Ricci curvature, the convexity of volume and minimal Lagrangian submanifolds”, to appear in *J. Symplectic Geom.* (expected issue: Vol. 21, no. 6, 2023).
- 15) Pacini, “Extremal length in higher dimensions and complex systolic inequalities”, *J. Geom. Analysis* 31 (2021), 5073-5093.
- 14) Lotay-Pacini, “From Lagrangian to totally real geometry: coupled flows and calibrations”, *Comm. Anal. and Geom.* 28 (2020) n. 3, 607-675.
- 13) Lotay-Pacini, “From minimal Lagrangian to J-minimal submanifolds: persistence and uniqueness”, *Boll. UMI* 12 (2019), Issue 1-2, 63-82 (volume in memory of P. de Bartolomeis).
- 12) Pacini, “Maslov, Chern-Weil and mean curvature”, *J. of Geometry and Physics* 135 (2019), 129-134.
- 11) Lotay-Pacini, “Complexified diffeomorphism groups, totally real submanifolds and Kaehler-Einstein geometry”, *Trans. Amer. Math. Soc.* 371 (2019), Number 4, 2665-2701.
- 10) Corti-Haskins-Nordstrom-Pacini, “ G_2 manifolds and associative submanifolds via semi-Fano 3-folds”, *Duke Math. J.* 164 (2015), no. 10, 1971-2092.
- 9) Corti-Haskins-Nordstrom-Pacini, “Asymptotically cylindrical Calabi-Yau 3-folds from weak Fano 3-folds”, *Geometry and Topology* 17 (2013), 1955-2059.
- 8) Pacini, “Special Lagrangian conifolds, I: moduli spaces”, *Proc. LMS* (3) 107 (2013), 198-224.
- 7) Pacini, “Special Lagrangian conifolds, II: gluing constructions”, *Proc. LMS* (3) 107 (2013), 225-266.
- 6) Pacini, “Desingularizing isolated conical singularities: uniform estimates via weighted Sobolev spaces”, *Comm. Anal. and Geom.* 21 (2013), no. 1, 105-170.
- 5) Gangbo-Kim-Pacini, “Differential forms on Wasserstein space and infinite-dimensional Hamiltonian systems”, *Memoirs AMS* 211 (2011), no. 993.
- 4) Haskins-Pacini, “Obstructions to special Lagrangian desingularizations and the Lagrangian prescribed boundary problem”, *Geometry and Topology* 10 (2006), 1453-1521.
- 3) Pacini, “Deformations of asymptotically conical special Lagrangian submanifolds”, *Pacific J. Math.* 215 (2004), no. 1, 151-181.
- 2) Pacini, “Mean curvature flow, orbits, moment maps”, *Trans. Amer. Math. Soc.* 355 (2003), no. 8, 3343-3357.
- 1) Pacini, “Complex structures on $SO(M, g)$ ”, *Boll. Unione Mat. Ital. Sez. B Artic. Ric. Mat.* (8) 2 (1999), no. 3, 639-654.

Note: Other work includes:

- Pacini, “Variation formulae for the volume of coassociative submanifolds” was accepted by *Annals of Global Analysis and Geometry* in June 2023. I then retracted it in order to correct a mistake. I am currently revising it in collaboration with A. Raffero.
- Pacini, “Potential theory, submersions and calibrations” was submitted to a journal in 2022, and is currently under review.
- Pacini, “Pluri-subharmonic functions on complex tori, Ricci curvature and convexity” is available online, at www.arxiv.org. I will not submit it in its current form.

Pacini, CV Part 5: Presentations

Recent seminars (since 2021):

- 2023, Seminar semiklassische Analysis und Darstellungstheorie, Koln.
- 2022, Prague-Hradec Kralove seminar, Math. Inst. of the Czech Acad. of Sciences (online).
- 2022, Seminar in memory of P. de Bartolomeis, Firenze.
- 2022, Differential Geometry seminar, BIMSA, Beijing (online).
- 2022, Geometry seminar, Waterloo (online).
- 2022, Geometry seminar, Florida International University, Miami.
- 2021, Virtual seminar on geometry with symmetries (online).
- 2021, Geometry seminar, Lisbon (online).

Conference talks:

- 2023, *Real and Complex Manifolds: Topology, Geometry and Holomorphic Dynamics*, PRIN workshop, Roma.
- 2022, *Complex Analysis and Geometry XXVI*, Levico Terme.
- 2022, *Workshop on Stability in Mirror Symmetry*, AIM (California).
- 2021, *8th Eur. Math. Soc. Congress* (special session), Slovenia/online.
- 2019, *12th ISAAC Congress* (special session), Aveiro.
- 2019, *Complex Analysis and Geometry XXIV*, Levico Terme.
- 2018, *Complex Geometry and Lie Groups*, Firenze.
- 2018, *Geometria in Bicocca*, Milano.
- 2018, *Workshop on geometric analysis and general relativity*, Hong Kong.
- 2017, *Workshop on G₂ manifolds and related topics*, Toronto.
- 2017, *Constructions of compact exceptional holonomy spaces: past, present and future*, London.
- 2016, *Extremal Kähler metrics, reductive groups compactifications and stationary Lagrangians*, Crete.
- 2015, *School and Workshop on Geometric Analysis*, KIAS, Seoul.
- 2015, *Complex Analysis and Geometry XXII*, Levico Terme.
- 2015, *Mini-workshop on Differential Geometry*, Sendai.
- 2015, *7th OCAMI-TIMS-Kobe-Waseda Joint International Workshop on Differential Geometry, Geometric Analysis and Mathematical Physics*, Osaka.
- 2014, *Lagrangian submanifolds and related topics*, Milano.
- 2014, *G₂ manifolds*, SCGP, Stony Brook.
- 2014, *G₂ days 2014*, London.
- 2014, *First Joint International Meeting RSME-SCM-SEMA-SIMAI-UMI*, Bilbao.
- 2014, *Carnival Differential Geometry school*, Torino.
- 2014, *Secondo workshop su varietà reali e complesse*, Pisa.
- 2012, *Optimal Transportation and Differential Geometry*, BIRS.
- 2012, *Manifolds with Special Holonomy and their Calibrated Submanifolds and Connections*, BIRS.

- 2011, *Taiwan international conference on geometry: Special Lagrangians and related topics*, National Taiwan University.
- 2008, *Giornate di Geometria Algebrica ed Argomenti Correlati*, Trento.
- 2006, *Southeast Geometry Seminar*, Univ. of Alabama.
- 2005, *Southeast Geometry Seminar*, Atlanta.
- 2005, *Recent advances in Calculus of Variations and PDEs*, Pisa.
- 2003, *Geometry of Lagrangian submanifolds*, IPAM, Los Angeles.
- 2002, *Proprieta' geometriche delle varieta' reali e complesse. Nuovi contributi italiani*, Palermo.
- 2002, *Joint conference AMS-UMI*, Pisa.
- 2001, *Network meeting of the European project on Complex Analysis and Analytic Geometry*, Paris.
- 1997, *Nuovi contributi italiani alla Geometria Differenziale*, Bari.

Pacini, CV Part 6: Student mentoring

Ph.D. thesis advisor (Mathematics dept.):

- Roberta Maccheroni, Univ. of Parma (graduated 2019).

Master thesis advisor (Mathematics dept.):

- Mattia Morbello, Univ. of Torino (graduated 2022).

BA thesis advisor (Mathematics dept.):

- Rosa Marchesini, Univ. of Torino (graduated 2018).
- Giovanni Ruffinengo, Univ. of Torino (graduated 2020).
- Nicolò Canavese, Univ. of Torino (graduated 2021).
- Alberto Pipitone, Univ. of Torino (graduated 2022).

BA thesis advisor (Physics dept.):

- Armando Leo, Univ. of Torino (graduated 2022).
- Alberto Lancellotti, Univ. of Torino (graduated 2022).
- Pietro Giura, Univ. of Torino (graduated 2023).
- Vincenzo Ganci, Univ. of Torino (graduated 2023).
- Fabio Cocito, Univ. of Torino (graduation expected 2023).
- Simone Orlando, Univ. of Torino (graduation expected 2023).

Note: Also:

- Referee for Ph.D theses for SISSA (2013), Scuola Normale Superiore (2018).
- Committee member for a Ph.D thesis at the Univ. of Malaga (2021).
- “Controrelatore” for several MS theses at the Univ. of Torino.

Pacini, CV Part 7: Teaching

Highlights:

- I have extensive teaching experience at all levels of university degree programs, summer schools, etc., and with all class sizes: from massive classes (120+ students) at Engineering and Physics departments, to Ph.D reading courses with a single student.
- Recent student evaluations at Univ. of Torino have been consistently very high on key questions such as “Stimolo interesse”, “Chiarezza espositiva”, “Reperibilita' docente”.
- For the past two years I have been carefully restructuring the course Geometria e Algebra Lineare - GAL2 (third year, Physics dept, Univ. of Torino), so as to improve its relevance to Physics students and to emphasize relationships with other courses.
- I have developed course notes for the following courses: Geometria e Algebra Lineare - GAL1, Geometria e Algebra Lineare - GAL2, Riemann surfaces and Complex Geometry, Introduction to Gauge Theory.

1) Undergraduate degree programs:

University of Torino:

- Riemann surfaces and complex geometry: 2016-17, 2017-18, 2018-19, 2019-20, 2020-21.
- Geometry and Linear Algebra, I: 2017-18, 2018-19, 2019-20, 2020-21, 2021-22, 2022-23.
- Geometry and Linear Algebra, II: 2021-22, 2022-23.
- Probability and Statistics: 2016-17.
- Calculus: 2016-17.

University of Pisa (School of Engineering):

- Linear Algebra and Geometry: 2016.

Scuola Normale Superiore:

- Introduction to several complex variables (undergrad/grad): 2016.
- Riemann surfaces (undergrad/grad): 2016.
- Complex Analysis: 2014-2015.
- Complex Analysis: 2013-2014.
- Mathematical methods for Chemistry (undergrad/grad): 2012-2013.
- Real Analysis (Exercise sessions), 2009-2010, 2010-2011, 2011-2012, 2012-2013, 2015-2016.

University of Oxford:

- B4 Analysis II (Class tutor), Hilary Term 2008.

Georgia Institute of Technology:

- Differential Geometry (undergrad/grad), Fall 2003.
- Ordinary Differential Equations, Spring 2004.
- Calculus 3, Fall 2004.
- Math. methods for Engineers (undergrad/grad), Spring 2005.
- PDE I (undergrad/grad), Fall 2005.
- Calculus 3, Spring 2006.

2) Graduate degree programs:

University of Torino:

- Introduction to K3 surfaces (graduate reading course): 2022-2023.
- Introduction to Gauge Theory (graduate): 2020-2021, 2021-2022.
- Topics in one complex variable (graduate): 2018-2019.

Also: joint degree courses at Scuola Normale Superiore and Georgia Institute of Technology (listed above).

3) Mini-courses, summer programs:

Nesin Mathematical Village, Turkey:

- Variation formulae in Kahler and G2 geometry (winter school), 2023.
- Conformal invariants and quasi-conformal maps (winter school), 2020.

Centro de Giorgi, Pisa:

- Introduction to the Ricci flow on surfaces (summer school): 2016.

Hokkaido University:

- Introduction to Mean Curvature Flow (first joint Hokkaido/Pisa summer school), 2015.

National Taiwan University:

- Introduction to special Lagrangian geometry (summer school), 2011.

Imperial College:

- Calibrations and special Lagrangian submanifolds (graduate), 2002.

Pacini, CV Part 8: Service

Scientific committees:

- Member of the scientific committee of Geometry-Topology schools, Nesin Mathematical Village, Turkey, (2020-onwards).
- Member of the “Collegio dei garanti” which oversees the awarding of a post-doc fellowship in memory of P. de Bartolomeis, Univ. of Florence (2017-onwards).

Organizational activities (selection):

- Co-organizer of the fifth joint Hokkaido/Pisa/Tor Vergata/Torino summer school, 2023.
- Co-organizer of the conference “Geometric Analysis Meeting”, Torino, 2022.
- Co-organizer of the conference “Geom. An, sub.s and geom. PDEs”, Torino, 2019.
- Co-organizer of the workshop “Differential Geometry Day”, Torino, 2019.
- Co-organizer of the workshop “Zoll metrics and holomorphic discs”, Giessen, 2018.
- Co-organizer of the workshop “Pluri-pot. theory and cal. geometry”, Torino, 2018.
- Co-organizer of the workshop “Open problems in G2 geom. and rel. topics”, Pisa, 2017.
- Co-organizer of the conference “Perspectives in Geometry”, Florence 2017.
- Co-organizer of the second joint Hokkaido/Pisa summer school, Pisa, 2016.
- Coordinator of the Geometry/Topology seminar, GT, 2003-2004.

Referee work (excluding journals):

- Peer reviewer for grant proposals submitted to EPSRC, UK, (2011) and NSERC, Canada, (2018).
- Referee for conference proceedings, Seasonal Institute, Math. Soc. of Japan (2018).

Referee work (journals):

- Advances in Mathematics;
- Annali della Scuola Normale Superiore;
- Annals of Global Analysis and Geometry;
- Calculus of Variations and PDEs;
- Communications in Analysis and Geometry;
- Comptes Rendus Mathématiques;
- Duke Mathematical Journal;
- Geometry and Topology;
- International Mathematics Research Notices;
- J. Differential Geometry;
- J. de l'École Polytechnique – Mathématiques;
- J. Functional Analysis;
- J. Geometric Analysis;
- J. Geometry and Physics;
- J. London Math. Society;
- J. Symplectic Geometry;
- Mathematische Annalen;
- Muenster Journal of Mathematics;
- Proc. London Math. Society;

- Rendiconti del Circolo Matematico di Palermo;
- Rendiconti del Seminario Matematico della Universita' di Padova;
- Rendiconti del Seminario Matematico dell'Universita' e del Politecnico di Torino;
- SIAM Journal of Mathematical Analysis;
- Trans. Am. Math. Soc.

Other committee work:

- Member of the PhD admissions committee, Univ. of Torino (2017, 2023) and Scuola Normale Superiore (2014-2018).
- Member of the post-doc hiring committee, Univ. of Torino (2019).
- Member of MS admissions committee, Univ. of Torino (2017-2019).
- Member of the teaching committee, Univ. of Torino (2018-onwards)
- Member of the “mathlab” committee, Univ. of Torino (2018-2022).
- Member of many MS and PhD thesis committees at Univ. of Torino and Scuola Normale Superiore.
- Member of the undergraduate admissions committee, Scuola Normale Superiore.
- Representative at Science Faculty board, Scuola Normale Superiore (2012-2016).
- Representative at Committee for Equal Opportunities, Scuola Normale Superiore (2010-2014).

Other service:

- Mathematical activities for elementary school students, Pisa (2015-2016).
- Teaching mentor for graduate students, GT (2004).
- Reviewer for Mathematical Reviews, AMS (2002-2004).