

Tristan RIVIÈRE

Birth date : november 26th, 1967.

3 children.

French citizenship.

*Address : D-Math, ETH-Zentrum,
CH-8092 Zürich.*

email : riviere@math.ethz.ch



Diplomas

1997 : Accreditation to supervise Researches (Habilitation à diriger des recherches), Paris-Orsay University.

1993 : PhD Thesis, Paris VI University .

1991 : DEA d'Analyse non-linéaire de Paris VI (Post Graduate Diploma).

1990 : Graduated from the Ecole Polytechnique France.

Positions :

2009- . : Director of the *Forschungsinstitut für Mathematik* - ETH-Zürich.

2003- . : Full professor at the ETH-Zürich.

2001-2002 : Assistant professor at the ETH-Zürich.

1992-2001 : Chargé de recherches CNRS-France.

Visiting position abroad :

1999-2000 : Associate professor at the CIMS, New-York University.

Distinctions :

2003 : Gold Medal "*Guido Stampacchia*" of the Italian Mathematics Society.

2002 : Invited speaker at the International Congress of Mathematicians - Beijing.

1996 : Bronze Medal of the CNRS France.

Research interests :

Analysis of Partial Differential Equations in Differential Geometry and Physics, Calculus of variations, Geometric Analysis, Geometric Measure Theory and PDE, Analysis and Geometry of Blow-ups, Shocks and defects in PDE .

Main achievements since 2003 :

Regularity of calibrated rectifiable currents (Proof of the fact that the singular set of 1-1 integral currents in arbitrary almost complex manifolds is made of isolated points). Analysis in high dimensional Gauge theory (partial regularity of stationary Yang-Mills fields in high dimension). Geometric structure of shocks for solutions to hyperbolic scalar conservation laws (extension of Lax-Oleinick rectifiability result for shocks to non entropic solution whose entropy distribution is a Radon measure). Non linear Function Space Theory : Fundamental properties of Sobolev Spaces between manifolds. Analysis of 2 dimensional conformally invariant lagrangians (resolution of Hildebrandt's conjecture on the regularity of critical points to 2-dimensional conformally invariant Lagrangians). Analysis of Willmore surfaces (identification of Palais Smale limits for the Willmore Lagrangian).

Present main research projects :

1) Regularity of Special Lagrangian Currents. Regularity of Weak Solutions to the SU(4)-Instanton equations in Calabi-Yau 4-folds. The two previous issues are required for giving an Analysis definition of Holomorphic Casson invariant "counting" holomorphic structures for complex bundles over a Calabi-Yau 4-folds. This project is a joint project with Gang Tian.

2) Study unique continuation properties for Dirichlet Minimizing multi-valued graphs. This is part of a joined program together with Camillo Delellis probably leading to an independent new proof of the codimension 2 partial regularity result by Almgren for area minimizing integral currents.

3) Developing the analysis of Willmore surfaces and Willmore-flow based on my recent discovery of conservation laws equivalent to Willmore equations.

4) Study of the sequentially weak density of smooth maps in Sobolev Spaces between manifolds. This is a joined project with Robert Hardt.

5) Study of the geometric structure of the shocks for solutions to hyperbolic scalar conservation laws.

Teaching :

Graduate and undergraduate courses at the *Ecole Normale Supérieure de Cachan*, *New-York University* and the *Eidgenössische Technische Hochschule Zürich*.

Organisation of conferences :

- “Calculus of Variation”, Oberwolfach (2002).
- DMV-Seminar “Ginzburg-Landau Vortices”, Oberwolfach (2002).
- “Calculus of Variations”, Oberwolfach (2004).
- “Calculus of Variations”, Oberwolfach (2006).
- ”Geometry and PDE”, Luminy (2007).

Member of Editorial Boards :

- Advances in Calculus of Variations.*
- Advances in Mathematics.*
- Analysis and PDE.*
- Annals of Global Analysis and Geometry.*
- Communications in Partial Differential Equations.*

PhD students :

- Reza Pakzad (1997-2000).
- Myriam Lecumberry (2000-2003).
- David Pumberger (2003-2007).
- Thiemo Kessel (2004-2008).
- Michael Blaser (2006-2011)
- Laura Keller (2007-2011)
- Costante Bellettini (2006-2011)
- Mircea Petrache (2008-?)

Services to the Math. Departement of ETH :

- Head of the Mathematics Library of ETH since 2003.
- Member of Personnel Committees (Hiring of full and associate professors, assistant professors, Heinz-Hopf lecturers, post-docs).

Invited speaker at international conferences (*since 2001*):

2001

- International PDE Conference of Huangshan, China (june).
- International Conference in honor of Stefan Hildebrandt, Leipzig (june).
- Singular Variational Problems, Cambridge (june).
- 2nd Workshop on “ Harmonic Maps and related topics”, Luminy (july).
- Concentration Phenomena and Vortex Dynamics, PIMS Vancouver (july).
- Partial Differential Equations , Oberwolfach (august).

2002

- Analysis of Partial Differential Equations, Forges Les Eaux (june).
- Harmonic Maps, Minimal Surfaces and Geometric Flows, Brest (july).
- International Congress of Mathematicians, Beijing (august).
- Calculus of Variations and Nonlinear Phenomena, Martina Franca (september).
- Aspects of Shock Wave Theory, Leipzig (october).
- Modélisation du Micromagnétisme, Luminy (december).

2003

- Partial Differential Equations in Applied Mathematics, Nice (february).
- Calculus of Variations, Warwick (May).
- Variational Analysis and Applications, Erice (june).
- Mathematical Models from Field Theory, Taiwan (july).
- Perspectives in Differential Geometry, PIMS-Vancouver (august).
- Workshop on Calculus of Variations, Fields Institute-Toronto (august).
- Partial Differential Equations, Oberwolfach (august).
- Almost Complex Geometry and Pseudo Holomorphic Laminations, Freiburg (september).
- Geometric Analysis, Pisa (november).
- Geometric Analysis, MSRI Berkeley (december).

2004

- Analysis on Manifolds, Fribourg (june).
- Variational Problems in Materials Science, SISSA Trieste (september).
- Trends in the Calculus of Variations, Parma (september).
- Singularities and Materials, Minnesota (october).
- Prospects in Geometry, Leipzig (november).
- Differential Geometry, Tokyo (december).

2005

- Ginzburg-Landau Days, Creteil (april).
- Micromagnetics : Analysis and Computation, Berlin (april).
- Analytic Aspects of Problems in Riemannian Geometry, Brest (may).
- Calculus of Variations and Non linear PDE. *In honor of R.Hardt, R.Gulliver and L.Simon*, Hangzhou (june).
- Partial Differential Equations, Oberwolfach (july).
- Analysis and Geometric Singularities, Oberwolfach (august).

2006

- Analysis of Partial Differential Equations, Evian (june).
- Pan Pacific Workshop on Complex Geometry, Huang-Shan (august).
- Micromagnetics: Experiments, modeling and mathematical theory, Bonn (september).
- PDE and Materials, Oberwolfach (september).
- Swiss Mathematical Society Meeting, Zürich (september).

2007

- Geometric flows and related topics, Warwick (march).
- Mathematical Theory of Liquid Crystals and Superconductivity, Shanghai (may).
- Geometric Analysis and Nonlinear PDE, Bedlewo (june).
- Des EDP au Calcul Scientifique, *In honor of L.Tartar*, Paris (july).
- Mathematical Aspects of Material Sciences - ICIAM 07, Zürich (july).
- Partial Differential Equations, Oberwolfach (july).
- Loss of compactness in nonlinear PDE, Banff (august).

2008

- Workshop on Variational Methods for Nonlinear PDE, Haifa (march).
- Second Canada-France Mathematical Congress, Montreal (june).
- School and Conference on Differential Geometry, Trieste (june).
- Conformal Geometry : Invariant theory and variational Methods Roscoff (july).
- Non-linear PDE and Geometric Analysis Harbin-China (july).
- Calculus of Variations, Oberwolfach (july).
- Mathematics of Biological Membranes, Oberwolfach (september).
- Perspectives in Geometric Analysis, Beijing (october).
- Workshop on Geometric Analysis, Bonn (november).

2009

- Geometric partial Differential Equation, Princeton (february).
- Conference on Elliptic and Parabolic Problems, Gaeta (may).
- Non-linear PDE and free boundary problems, Warwick (june).
- Asymtotic analysis in Calculus of Variations, Vancouver (july).
- Workshop on Partial Differential Equation, Oberwolfach (august).
- Conference in Geometric Analysis, Pisa (september).
- Variational Problems of Higher Order in Geometry, Berlin (september)
- Loss of compactness in nonlinear problems, Luminy-Marseille (october)

2010

- plenary speaker at the DMV meeting 2010 in Munich (march).
- plenary speaker at the Rivire-Fabes Symposium Minneapolis (april).
- International conference on geometric non-linear PDE, Beijing (june).
- XVI School of Differential Geometry in Sao Paulo-Brasil (july).
- Calculus of Variations, Oberwolfach (july).
- École Thématique d'Analyse Géométrique, Roscoff-France (october).
- Mini-symposium in PDE Edinburgh (november).

2011

- Nonlinear Phenomena, Taiwan (january).
- Analyse Géométrique CIRM-Marseille (january).
- The Vienna ETH-Day, Schrödinger Institute Vienna (march).
- Geometric and Nonlinear Analysis: Meeting in Lorraine, France (june).
- Geometric Analysis, Edinburgh-Scotland (june).
- Non-linear hyperbolic PDE's, Sissa-Trieste, Italy (july).
- Partial Differential Equations Oberwolfach-Germany (august).
- Geometry meets transport, Nice-France (september).
- Perspectives in Mathematics, (BICMR) Beijing-China (october).
- Journées d'analyse géométrique de Lyon, France (october).

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PUBLICATIONS

1. (with I.Shafrir) *Asymptotic analysis of minimizing harmonic maps of region bounded by two cylinders*, **C.R.Acad.Sc. Paris**, 313, (1991), pp 503-508.
2. *Applications harmoniques de B^3 dans S^2 ayant une ligne de singularités*, **C.R.Acad.Sc. Paris**, 313, (1991), pp 583-587.
3. *Applications harmoniques de B^3 dans S^2 partout discontinues*, **C.R.Acad.Sc. Paris**, 314, (1992), pp 719-723.
4. *Applications harmoniques partout discontinues*, **Séminaires EDP, Ecole Polytechnique**, XIX, (1992).
5. *Harmonic maps from B^3 into S^2 having a line of singularities*, published in “Applications harmoniques entre variétés”: **Thèse de l’université Paris 6**, (1993).
6. *Infinités des applications harmoniques à valeur dans une sphère pour une condition au bord donnée*, published in “Applications harmoniques entre variétés”: **Thèse de l’université Paris 6**, (1993).
7. *Flot des applications harmoniques en dimension deux*, published in “Applications harmoniques entre variétés”: **Thèse de l’université Paris 6**, (1993).
8. *Harmonic maps with values into Torii of revolution*, published in “Applications harmoniques entre variétés”: **Thèse de l’université Paris 6**, (1993).
9. *Everywhere discontinuous Harmonic Maps into Spheres*, **Acta Mathematica**, 175, (1995),197-226.
10. (with H.Brezis and F.Merle) *Effets de quantification pour $-\Delta u = u(1 - |u|^2)$ sur \mathbb{R}^2* , **C.R.Acad.Sc. Paris**, 317, (1993), pp 57-60.
11. (with H.Brezis and F.Merle) *Quantization effects for $-\Delta u = u(1 - |u|^2)$ in \mathbb{R}^2* , **Arch. Rat. Mech. and Anal.**, 126, (1994),pp 123-145.

12. (with F.Bethuel) *Vortices for a variational problem related to Superconductivity*, **Annales de l'I.H.P.**, Analyse non linéaire, 12 (1995), 243-303.
13. (with D.Ye) *Une résolution de l'équation à forme volume prescrite*, **C.R.Acad.Sc. Paris**, 319, (1994), 25-28.
14. (with D.Ye) *Resolutions of the prescribed volume form equation*, **Non linear Diff. Equations and Applications**, 3, (1996), 323-369.
15. (with F.Bethuel) *Fonctionnelle de Ginzburg-Landau pour la supraconductivité*, Exposé au **seminaire EDP de l'Ecole Polytechnique**, (mars 94).
16. *Lignes de tourbillons dans le modèle abélien de Higgs*, **C.R.Acad.Sc. Paris**, 321, (1995), 73-76.
17. *Line vortices in the $U(1)$ -Higgs Model*, **ESAIM Controle Optimal Calc .Var.**, vol 1, 1996, 77-167.
18. *Minimizing Fibrations and p -Harmonic maps in Homotopy Classes from S^3 into S^2* , **Comm. Anal. Geom.**, 6, (1998), 427-483.
19. *Asymptotic analysis for the Ginzburg-Landau Equations* Mini-course ETH Zürich 1997, **Bolletino UMI**, 2-B, (1999) 8, 537-575.
20. (with F.H. Lin) *Complex Ginzburg-Landau Equations in high dimensions and codimension 2 Minimal surfaces*, **J. European Math. Soc.**, 1, (1999) 3, 237-311.
21. (with F. Pacard) *On the set of Minimizers of the Ginzburg-Landau Functional in dimension 2* in *Harmonic Morphisms, Harmonic Maps and related Topics (Brest 97)* **Pitman Research notes in Math. Series**, CRC Press.
22. *On the use of differential forms for the Skyrme Problem*, **Letters in Math. Phy.**, 45, 3, 229-238 (1998).
23. (with F. Pacard) *Linear and Non-linear Aspects of Vortices*, Progress in P.D.E. **Birkhäuser** (2000).

24. *Towards Jaffe and Taubes Conjectures in the strongly repulsive limit*, **Manuscripta Mathematica**, 108, (2002).
25. *On Dense subsets of $H^{\frac{1}{2}}(S^2, S^1)$* , **Glob. Anal. and Geom.** , 18, 5, (2000), 517-528.
26. *Ginzburg Landau Vortices - The static Model*, **Bourbaki Seminar** exposé no 868, (1999).
27. (with F.H. Lin) *A Quantization property for static Ginzburg-Landau Vortices*, **Comm. Pure App. Math.**, 54, (2001), 206-228.
28. (with F.H. Lin) *Energy Quantization for Harmonic Maps*, **Duke J. Math.**, 111, (2002) 217-273.
29. (with S. Serfaty) *Limiting domain wall Energy for a Problem related to Micromagnetism*, **Comm. Pure App. Math.**, 54, (2001), 294-338.
30. *High-dimensional Helicities and rigidity of linked Foliations*, **Asian J. Math.**, 6, (2002), 505-533.
31. (with F.H. Lin) *Quantization property for moving Line vortices*, **Comm. Pure App. Math.**, (2001).
32. (with R. Hardt) *Connecting Topological Hopf Singularities*, **Ann. Sc. Norm. Sup. Pisa V**, 2,(2003) 287-344.
33. (with M.R. Pakzad) *Weak density of smooth maps for the Dirichlet Energy between manifolds*, **Geom. Funct. Anal.**, 13, (2003), 223-257.
34. *Interpolation Spaces and Energy Quantization for Yang-Mills Fields*, **Comm. Anal. Geom.**, 10, (2002), 683-708.
35. (with R.Hardt) *Ensembles singuliers topologiques dans les espaces fonctionnels entre variétés*, **Séminaire EDP, École Polytechnique**, (december 2000).
36. (with S.Serfaty) *Compactness, kinetic formulation and entropies for a problem related to Micromagnetics*, **Comm. Partial Differential Equations**, 28, (2003), 249-269.

37. (with Y.Meyer) *A Partial Regularity for a class of stationary Yang-Mills Fields.*, **Rev. Mat. Iberoamericana**, 19, (2003), 195-219.
38. (with A.Aftalion) *Vortex energy and vortex bending for a rotating Bose-Einstein condensate*, **Physical Review A**, 64, 043611 (2001), 1-7.
39. (with M.Lecumberry) *Regularity property for Micromagnetic configurations having zero jump energy*, **Calc. Var. and P.D.E.**, 15, (2002), 389-402.
40. (with G.Tian) *The singular set of J -holomorphic maps into algebraic varieties* **J. für Reine. Angew. Math.** 570, (2004), 47-87.
41. (with F. Alouges and S. Serfaty) “Néel and cross-tie wall energies for planar magnetic configurations” A tribute to J.L.Lions, **ESAIM Controle Opt.Calculus Variations**, 8, (2002), 31-68.
42. (with L.Ambrosio and M.Lecumberry) “A viscosity property of minimizing micromagnetic configurations”, **Comm. Pure and App. Math.**, 56, (2003), 681-688.
43. (with L.Ambrosio, B. Kirchheim and M.Lecumberry) “Rectifiability of defect measures arising in micromagnetic domains”, Volume dedicated to the 80th birthday of O. Ladyzhenskaya, 29-60, **Int. Math. Ser.** (N.Y.), 2, Kluwer/Plenum
44. “Parois et vortex en micromagnétique”, **Journées équations aux dérivées partielles**, (Forges-les-eaux, 2002), Exp. No. XIV, Univ. Nantes, Nantes 2002.
45. (with M.Lecumberry) “The rectifiability of shock waves for the solutions of genuinely non-linear scalar conservation laws in 1+1 D” **PhD Thesis of M. Lecumberry**, Nantes (2002).
- 46 “Bubbling, quantization and regularity issues in geometric non-linear analysis” **ICM Beijing** (2002).
- 47 (with C.Delellis) “The Rectifiability of Entropy Measures in one Space dimension.” **Journal de Math. Pures et App.**, 82, (2003), 1343-1367.

- 48 “Some problems from the non-linear analysis of high dimensional Gauge Theory” Variational Analysis and applications, Volume in memory of G.Stampacchia, Erice-Sicily, (2003).
- 49 “A lower-epiperimetric inequality for area minimizing surfaces” **Comm. Pure App. Math.** 57,(2004), no 3, 273-285.
- 50 “Approximating J -holomorphic curves by holomorphic ones” to appear in **Calc. Var. P.D.E.**, 21, (2004), no 3, 273-285.
- 51 (with P.Strzelecki) “A sharp nonlinear Gagliardo-Nirenberg-type estimate and applications to the regularity of elliptic systems.” **Comm. P.D.E.** 30 (2005), no. 4-6, 589–604.
- 52 “Conservation laws for solutions to Schrödinger systems with antisymmetric potentials” . GDR CNRS EDP Evian (2006)
- 53 “Sobolev critical exponents of rational homotopy groups.” **Quarterly J. of Pure and App. Math.**, issue in honor of L.Simon, 3 (2007), no 2, 615-630.
- 54 Conservation laws for conformally invariant variational problems . **Invent. Math.**, 168 (2007), 1-22.
- 55 (with M. Struwe) “Partial regularity for harmonic maps, and related problems” **Comm. Pure and App. Math.** 61 (2008), no. 4, 451-463.
- 56 (with T. Lamm) “Conservation laws for fourth order systems in four dimensions.” **Comm. P.D.E.** 33 (2008), no. 2, 245-262.
- 57 (with R.Hardt) “Connecting rational homotopy type singularities of maps between manifolds” **Acta Math.**, 200 (2008), 15-83.
- 58 (with D. Pumberger) “Uniqueness of tangent cones for semi-calibrated integral 2-cycles”, to appear in **Duke Math. J.** (2009).
- 59 (with T. Kessel) “Sobolev bundles and weak curvatures”, **Bull. U.M.I.**, 9-I (2008), 881-901 *volume dedicated to the memory of G. Stampacchia* .

60 "The role of integrability by compensation in Conformal Geometric Analysis" to appear in *Analytic aspects of problems from Riemannian Geometry SMF , séminaires et Congrès*, 19, (2008).

61 "Analysis Aspects of Willmore Surfaces" **Inventiones Math.**, 174 (2008), no. 1, 1-45.

62 (with Y. Bernard) "Local Palais-Smale sequences for the Willmore Functional" to appear in **Comm. Analysis and Geom.** (2011).

63 "Error Analysis for the Willmore-Helfrich Functional", **Oberwolfach Reports Mathematics of Biological Membranes** (2008) 2305-2309.

64 (with G. Tian) "The singular set of 1-1 Integral currents" **Annals of Math**, 169 (2009), no. 3, 741-794.

65 (with C. Bellettini) "The regularity of Special Legendrian Integral Cycles.", to appear in **Ann. Sc. Norm. Sup. Pisa** (2011).

66 (with F. Da Lio) "3-commutator estimates and the regularity of 1/2-harmonic maps in the critical dimension", **Analysis and PDE** 4 (2011), no. 1, 149–190.

67 (with M. Blaser) "Minimality properties for entropy solutions to hyperbolic scalar conservation laws" **Comm. P.D.E.** 35 (2010), no. 10, 17631801.

68 Sub-criticality of Schrödinger systems with antisymmetric potentials. **J. Math. Pures Appl.** (9) 95 (2011), no. 3, 260276

69 (with F. Da Lio) : "The regularity of solutions to critical non-local Schrödinger systems on the line with antisymmetric potential and applications" **Advances in Math.** 227 (2011) 1300-1348.

70 (with M. Petrache) : "Weak closure of singular abelian L^p -bundles in 3-dimensions", to appear in **GAF**A (2011).

71 "Variational Principles for immersed Surfaces with L2-bounded Second Fundamental Form." preprint (2010).

72 "Lipschitz conformal Immersions from degenerating Surfaces with L2-bounded Second Fundamental Form". preprint (2010)

73 (with Y. Bernard) : "Aymptotic Analysis of Branched Willmore Surfaces", arXiv:1106.4642 preprint (2011).

74 (with Y. Bernard) : "Energy Quantization for Willmore Surfaces and Applications" arXiv:1106.3780 preprint (2011).