

# Dario Prandi

Chargé de recherche CNRS at L2S

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## Experience

- Chargé de Recherche CNRS**, L2S, CentraleSupélec, Gif-sur-Yvette 2016–now  
Researcher in Section 07.
- Post-doc**, CEREMADE, Université Paris-Dauphine, Paris 2015–2016  
Supervisors: [G. Peyré](#) and [J.-M. Mirebeau](#).
- Post-doc**, LSIS, Université de Toulon, Toulon 2014–2015  
Grant of the LabEx Archimède (Aix-Marseille Université). Supervisor: [J.-P. Gauthier](#).

## Education

- Philosophiae Doctor (Ph.D.)**, École Polytechnique, Palaiseau 2010–2013  
Subject of the dissertation: [Geometry and analysis of control-affine systems: motion planning, heat and Schrödinger evolution](#). Supervisors: [Ugo Boscin](#), [Frédéric Jean](#), and [Mario Sigalotti](#).
- Master of Science (M.Sc.)**, Dep. of Mathematics, Univ. di Padova, Italy 2008 – 2010  
Final grade 110/110 *cum laude*. Specialised curriculum in mathematical analysis. Subject of the dissertation: Rearrangements in Metric Spaces. Supervisor: [Roberto Monti](#).
- Bachelor of Science (B.Sc.)**, Dep. of Mathematics, Univ. di Modena e Reggio Emilia, Italy 2005 – 2008  
Final grade 110/110 *cum laude*. General curriculum in mathematics. Subject of the dissertation: Area and coarea formulae. Supervisor: [Gian Paolo Leonardi](#).

## Teaching

- Lecturer**, Geometric Control Theory (CM, 12h). 2018  
Master course, Université Paris-Sud Orsay.
- Lecturer**, Analyse et Topologie (CM and TD, 60h). 2015 – 2018  
Bachelor course (L2). PSL Research University, Paris.
- Teaching assistant**, Contrôle Géométrique (TD, 10h). 2013 & 2016  
Master course, Université Paris-Sud Orsay.
- Teaching assistant**, Outils Logiciels (TP, 50h). 2014  
Bachelor course, IUT de Toulon.

## Organization

- Cortical models for visual perception and imaging applications**, LJLL, UPMC, Paris. 22 nov 2018  
Website: <https://liftme.sciencesconf.org/>. Co-organised with L. Calatroni, V. Franceschi, and B. Franceschiello.
- Cortical Inspired Non-holonomic Control for Imaging**, Institut Henri Poincaré, Paris. 28 nov 2017  
Co-organised with L. Calatroni and V. Franceschi.
- Séminaire d'Automatique du Plateau de Saclay**, L2S, CentraleSupélec, Gif-sur-Yvette. oct 2016 – now  
Website: <https://icode-seminars.github.io>. Co-organised with N. Amini.
- A day in control theory**, CMAP, École Polytechnique, Palaiseau. 2 may 2017  
Thematic day in honour of A. Agrachev 65th birthday. Co-organised with F. Chittaro and R. Ghezzi.
- Spectral properties of hypoelliptic operators**, Institut Henri Poincaré, Paris. 9 dec 2015  
Website: <http://webusers.imj-prg.fr/~davide.barilari/seminar.php>.
- INDAM meeting on Geometric Control and sub-Riemannian Geometry**, Cortona, Italy. may 2012  
Website: <http://www.cmap.polytechnique.fr/geometric-control-srg/>.

## Grants and awards

<b>Financing from iCODE institut</b> , “Control theoretical modelling of contrast perception” “Porteur” of the project, in collaboration with V. Franceschi and L. Calatroni	2019
<b>PEPS Blanc INS2I</b> , “Lifting approaches for cortical inspired methods in imaging (LiftME)” “Porteur” of the project, in collaboration with V. Franceschi and L. Calatroni	2018
<b>PEPS Blanc INS2I</b> , “Cortical Inspired Non-holonomic Control for Imaging (CINCIN)” “Porteur” of the project, in collaboration with J.-P. Gauthier, V. Franceschi, L. Calatroni.	2017
<b>ERC Proof of Concept</b> , “An artificial visual cortex for image processing (ARTIV1)” Principal investigator: Ugo Boscain. In collaboration with J.-P. Gauthier and M. Sigalotti.	2016
<b>BOUM SMAI Project</b> , “Quantum confinement and spectral properties of singular operators” In collaboration with L. Rizzi and M. Seri.	2016
<b>BOUM SMAI Project</b> , “Formule de Santalò en géométrie sous-riemannienne et applications” In collaboration with L. Rizzi and M. Seri.	2016

## Supervision

<b>Nouamane Tazi</b> , CentraleSupélec student. Supervised under the “parcours recherche” offering of CentraleSupélec.	2018–pres.
<b>Amine Bohi</b> , Ph.D student in Computer Science, LSIS, Université de Toulon. Supervised in collaboration with F. Bouchara and J.-P. Gauthier. Subject of the dissertation: “Descripteurs de Fourier inspirés de la structure du cortex visuel primaire humain. Application à la reconnaissance de navires dans le cadre de la surveillance maritime”.	2014
<b>Leonardo Suriano</b> , INRIA Saclay engineer. Supervised in collaboration with M. Sigalotti.	2015

## Publications

### Books and edited proceedings

- [1] A semidiscrete version of the Petitot model as a plausible model for anthropomorphic image reconstruction and pattern recognition  
Dario Prandi, Jean-Paul Gauthier  
*SpringerBriefs in Mathematics*. Springer International Publishing. (2018)

### Peer-reviewed journals

- [1] On the regularity of abnormal minimizers for rank 2 sub-Riemannian structures  
Davide Barilari, Yacine Chitour, Frédéric Jean, Dario Prandi, Mario Sigalotti  
*Journal de Mathématiques Pures et Appliquées* (Apr. 2018)
- [2] A sub-Riemannian Santaló formula with applications to isoperimetric inequalities and first Dirichlet eigenvalue of hypoelliptic operators  
Dario Prandi, Luca Rizzi, Marcello Seri  
*J. Differential Geom.* 111.2 (Feb. 2019), pp. 339–379. doi: [10.4310/jdg/1549422105](https://doi.org/10.4310/jdg/1549422105)
- [3] On the Essential Self-Adjointness of Singular Sub-Laplacians  
Valentina Franceschi, Dario Prandi, Luca Rizzi  
*Potential Analysis* (Jan. 2019). doi: [10.1007/s11118-018-09760-w](https://doi.org/10.1007/s11118-018-09760-w)
- [4] Quantum confinement on non-complete Riemannian manifolds  
Dario Prandi, Luca Rizzi, Marcello Seri  
*J. Spectr. Theory* (July 2018). doi: [10.4171/JST/226](https://doi.org/10.4171/JST/226)
- [5] Highly Corrupted Image Inpainting Through Hypoelliptic Diffusion  
Ugo V. Boscain, Roman Chertovskih, Jean-Paul Gauthier, Dario Prandi, Alexey Remizov  
*J. Math. Imaging Vision* (Apr. 2018). doi: [10.1007/s10851-018-0810-4](https://doi.org/10.1007/s10851-018-0810-4)
- [6] Self-adjoint extensions and stochastic completeness of the Laplace-Beltrami operator on conic and anti-conic surfaces  
Ugo Boscain, Dario Prandi  
*J. Differential Equations*. 260.4 (2016), pp. 3234–3269. doi: [10.1016/j.jde.2015.10.011](https://doi.org/10.1016/j.jde.2015.10.011)

- [7] Spectral analysis and the Aharonov-Bohm effect on certain almost-Riemannian manifolds  
U. Boscain, D. Prandi, M. Seri  
*Comm. Partial Differential Equations*. 41.1 (2016), pp. 32–50. doi: [10.1080/03605302.2015.1095766](https://doi.org/10.1080/03605302.2015.1095766)
- [8] Fourier descriptors based on the structure of the human primary visual cortex with applications to object recognition  
Amine Bohi, Dario Prandi, Vincente Guis, Frédéric Bouchara, Jean-Paul Gauthier  
*J. Math. Imaging Vision*. 57.1 (2017), pp. 117–133. doi: [10.1007/s10851-016-0669-1](https://doi.org/10.1007/s10851-016-0669-1)
- [9] Complexity of control-affine motion planning  
F. Jean, D. Prandi  
*SIAM J. Control Optim.* 53.2 (2015), pp. 816–844. doi: [10.1137/130950793](https://doi.org/10.1137/130950793)
- [10] Hölder equivalence of the value function for control-affine systems  
Dario Prandi  
*ESAIM: COCV*. 20.4 (2014), pp. 1224–1248. doi: [10.1051/cocv/2014014](https://doi.org/10.1051/cocv/2014014)

## Peer-reviewed conferences and workshops

- [1] A Cortical-Inspired Model for Orientation-Dependent Contrast Perception: A Link with Wilson-Cowan Equations  
Marcelo Bertalmio, Luca Calatroni, Valentina Franceschi, Benedetta Franceschiello, Dario Prandi  
*Scale Space and Variational Methods in Computer Vision*. (2019). ISBN: 978-3-030-22368-7
- [2] Cortical-inspired image reconstruction via sub-Riemannian geometry and hypoelliptic diffusion  
Boscain, Ugo, Chertovskih, Roman, Gauthier, Jean-Paul, Prandi, Dario, Remizov, Alexey  
*SMAI 2017 – ESAIM: ProcS*. 64 (2018), pp. 37–53. doi: [10.1051/proc/201864037](https://doi.org/10.1051/proc/201864037)
- [3] Image inpainting via a control-theoretical model of human vision  
Ugo V. Boscain, Jean-Paul Gauthier, Dario Prandi  
*2018 14th IEEE International Conference on Control Automation (ICCA)*. (2018). doi: [10.1109/ICCA.2018.8444289](https://doi.org/10.1109/ICCA.2018.8444289)
- [4] Recent results on the essential self-adjointness of sub-Laplacians, with some remarks on the presence of characteristic points  
Dario Prandi, Valentina Franceschi, Luca Rizzi  
*Séminaire de Théorie spectrale et géométrie (Grenoble)*, 33. (2015-2016). doi: [10.5802/tsg.311](https://doi.org/10.5802/tsg.311)
- [5] Image processing in the semidiscrete group of rototranslations  
Dario Prandi, Ugo Boscain, Jean-Paul Gauthier  
*Geometric science of information*. Lecture Notes in Comput. Sci. Vol. 9389. (2015). doi: [10.1007/978-3-319-25040-3\\_67](https://doi.org/10.1007/978-3-319-25040-3_67)
- [6] Image reconstruction via non-isotropic diffusion in Dubins/Reed-Shepp-like control systems  
U. Boscain, J. P. Gauthier, D. Prandi, A. Remizov  
*53rd IEEE Conference on Decision and Control*. (Dec. 2014). doi: [10.1109/CDC.2014.7040056](https://doi.org/10.1109/CDC.2014.7040056)

## Preprints

- [1] Visual illusions via neural dynamics: Wilson-Cowan-type models and the efficient representation principle  
Marcelo Bertalmio, Luca Calatroni, Valentina Franceschi, Benedetta Franceschiello, Alexander Gomez-Villa, Dario Prandi  
*arXiv e-prints* (July 2019), arXiv:1907.13004
- [2] Hardy-type inequalities for the Carnot-Carathéodory distance in the Heisenberg group  
Valentina Franceschi, Dario Prandi  
arXiv: [1903.08486](https://arxiv.org/abs/1903.08486) [math.AP]
- [3] Weyl's law for singular Riemannian manifolds  
Yacine Chitour, Dario Prandi, Luca Rizzi  
arXiv: [1903.05639](https://arxiv.org/abs/1903.05639) [math.DG]
- [4] Point interactions for 3D sub-Laplacians  
Riccardo Adami, Ugo Boscain, Valentina Franceschi, Dario Prandi  
arXiv: [1902.05475](https://arxiv.org/abs/1902.05475) [math.AP]
- [5] Generalized Fourier-Bessel operator and almost-periodic interpolation and approximation  
J.-P. Gauthier, D. Prandi  
arXiv: [1612.00056](https://arxiv.org/abs/1612.00056) [math.NA]

## Talks in international conferences

- [1] Weyl law for singular Riemannian manifolds  
Journées sous-riemanniennes, Grenoble, France. 16 October 2018.
- [2] Weyl law for singular elliptic operators  
A sub-Riemannian day in Padova, Italy. 14 September 2018.
- [3] Cortical-inspired functional lifting for image inpainting  
SIAM conference on Imaging Science, Bologna, Italy. 5 June 2018.
- [4] Anthropomorphic image reconstruction via sub-Riemannian geometry and hypoelliptic diffusion  
Delays and constraints in distributed parameter systems, Gif-sur-Yvette, France. 24 November 2017.
- [5] Quantum confinement and spectral analysis of degenerate operators on Riemannian manifolds  
VII Partial differential equations, optimal design and numerics, Benasque, Spain. 22 August 2017.
- [6] A variational formulation of the sub-Riemannian model of the primary visual cortex  
Geometric Analysis in Control and Vision Theory, Voss, Norway. 11 May 2016.
- [7] Image processing in the semidiscrete group of rototranslations  
2nd Conference on Geometric Science of Information, École Polytechnique. 20 October 2015.
- [8] A sub-Riemannian Santaló formula with applications to isoperimetric inequalities and Dirichlet spectral gap of hypoelliptic operators  
PGMO Days 2015, ENSTA ParisTech, Palaiseau. 28 October 2015.
- [9] Self-adjointness of intrinsic diffusions in almost-Riemannian structures  
Thematic day on Analysis and geometry of almost-Riemannian manifolds, IHP, Paris. 03 December 2014.
- [10] Intrinsic hypoelliptic diffusions in sub-Riemannian and almost-Riemannian geometry  
Thematic day on Hypoelliptic diffusion: analysis and control, IHP, Paris. 06 November 2014.
- [11] Spectral properties and Aharonov-Bohm effect on Grushin-like structures  
First International Joint Meeting, Bilbao, Spain. 02 July 2014.
- [12] The Laplace-Beltrami operator on conic and anti-conic surfaces  
Geometry and Control, Steklov Institute, Moscow, Russia. 17 April 2014.
- [13] Heat and Schrödinger equation on conical and anticonical-type manifolds  
Control of PDEs, CNAM, Paris. 02 April 2014.
- [14] Complexity in control-affine systems  
Mathematical Control in Trieste, SISSA, Trieste, Italy. 05 December 2013.
- [15] Dynamics of a quantum particle on a conical-like surface  
Conical Intersections in Mathematical Physics, IHP, Paris. 31 May 2013.
- [16] The Laplace-Beltrami operator on conic-type surfaces  
Non Linear Control: Geometric Methods and Applications, Firenze, Italy. 19 April 2013

## Other talks

- [1] Self-adjointness e teoria spettrale per (sub-)laplaciani singolari  
Seminario FIM, Università di Modena e Reggio Emilia, Italy. 25 January 2018.
- [2] Loi de Weyl avec reste et estimés du noyau de la chaleur sur variétés riemanniennes non-completes  
Séminaire de Théorie spectrale et géométrie, Institut Fourier, Grenoble. 30 November 2017.
- [3] Sur le caractère auto-adjoint et la théorie spectrale des opérateurs de type Hörmander singuliers  
Séminaire d'Analyse, Université de Tours. 09 November 2017.
- [4] Quantum confinement and spectral theory of (sub-)Laplacians  
Séminaire de Géométrie sous-riemannienne, IHP, Paris. 04 October 2017.
- [5] Quantum confinement in non-complete Riemannian manifolds  
25e colloque Jeunes Chercheurs Alain Bouyssy, Orsay, Paris. 02 March 2017.
- [6] Neuro-geometry of vision and applications to image processing  
Seminario FIM, Università di Modena e Reggio Emilia, Italy. 11 February 2016.

- [7] A variational formulation of the sub-Riemannian model for the primary visual cortex  
Séminaire "Analyse numérique et EDP", Université Paris Sud-Orsay. 26 November 2015.
- [8] Reconstruction and pattern recognition via the Citti-Petitot-Sarti model  
Séminaire "Statistique et imagerie", Université Paris-Dauphine. 19 January 2015.
- [9] Complexity of control-affine motion planning  
Séminaire de Théorie du Contrôle de Toulon, Université de Toulon. 30 January 2014.
- [10] The heat and Schrödinger equations on conic and anticonic-type  
Gdt Problèmes spectraux et physique mathématique, Université Paris Sud-Orsay. 18 December 2013.
- [11] Complexity of control-affine motion planning  
Séminaire de Géométrie sous-riemannienne, IHP, Paris. 02 October 2013.
- [12] The heat and Schrödinger equations on conic and anticonic-type surfaces  
A geometry day in Bicocca, Milan, Italy. 27 September 2013.
- [13] Complexity in affine control systems  
Journée GECO, UPMC, Paris. 25 June 2012.
- [14] Complexity in affine control systems  
Functional Analysis sector's seminar, SISSA, Trieste, Italy. 19 April 2012.

## Posters

- [1] Hardy-type inequalities and spectral bounds for hypoelliptic operators of Hörmander type  
Contrôle des EDP et applications, CIRM, Marseille. 10 November 2015
- [2] Highly corrupted image inpainting through hypoelliptic diffusion  
Workshop on Geometrical Models in Vision, IHP, Paris. 23 October 2014.

## Languages

Mother tongue  
Other languages<sup>1</sup>

**Italian**

**English<sup>2</sup>**  
**French**

Understanding		Speaking		Writing	
Listening	Reading	Interaction	Production		
C2    Fluent	C2    Fluent	C2    Fluent	C2    Fluent	C2    Fluent	
C2    Fluent	C2    Fluent	C1    Fluent	C1    Fluent	C1    Fluent	

<sup>1</sup> Common European Framework of Reference for Languages (CEFR)

<sup>2</sup> TOEFL iBT Test. Score of 110/120.