

Curriculum Vitae

Marie-Claude Arnaud

Personal details

Name: Marie-Claude Arnaud
Born: 24 February 1963
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Marital Status: Married, 2 children (students)

Education and Qualifications

1983-87: student at Ecole normale supérieure de Paris : Bachelor in Math in 1984, agrégation of mathematics (teaching diploma) in 1985, DEA (M2) in Mathematics in 1986
1986-90: University Paris 7: PhD in Mathematics 'Periodic points and Lagrangian tori invariant by symplectic diffeomorphisms', advisor Michael Robert Herman.
1999: University Paris 11 (Orsay): Habilitation in Mathematics 'Periodic points of dynamical systems'.

Employment

1987-89: assistant normalien at university Louis Pasteur (Strasbourg)
1989-91: ATER at University Paris 7
1991-2001: Assistant professor at University Paris 11 (Orsay)
2001-: Full professor at university of Avignon.

Prizes, Awards and Honours

1983: entrance at Ecole Normale supérieure;
2007: promoted 1st class professor by the French National Council of the University;
2010: invited to give a talk in Dynamical System section at the International congress of mathematics at Hyderabad, India
2011: Prize Gabrielle Sand et M. Guido-Triossi of the French Academy of Sciences;
2013: promoted exceptional class professor by the French National Council of the University;
2013: senior member at the French Institute of France

Positions of responsibility

2002-2007: Director of the Math department of Avignon,
2013-: Leader of the team 'Dynamical system and geometry'

2016-: deputy director for Research of faculty of sciences, university of Avignon

Editorial board of the Annales de la Faculté des Sciences de Toulouse since 2015.

Contribution to Organisation of Meetings:

- Scientific committee : second congress of the French Mathematical Society, june 2018 in Lille, Beyond Hamilton-Jacobi, Last call to Bordeaux 9-13 january 2017, Beyond Hamilton-Jacobi in Avignon, 23-30 april 2014, Anosov systems, 18-22 june 2012, Dynamical Optimization in PDE and Geometry, applications to Hamilton-Jacobi, ergodic Optimization, weak KAM, Bordeaux, December 12-21 2011, colloque Nice weak KAM in Nice in february 2009, 3 days of Lagrangian Dynamics, marsch 2005 in Avignon (GDR 144)
- Organizing committee : Days of the French statistic society, 29 may-2 june 2017 in Avignon, Beyond Hamilton-Jacobi in Avignon 23-30 april 2014 (80 participants), First Dynamics day Avignon-Marseille, with Pascal Hubert at FRUMAM (Marseille) in june 2013, 12th German-French Congress in Optimisation in Avignon in september 2004 (180 participants)

Other administration:

2001-10: elected member of the Council of the Faculty of Sciences of the University of Avignon;

2001-2005 : responsible for the Seminar of Dynamical systems and Geometry at Avignon University;

2007-11: elected member of the National council of the University, section 25 (pure math);

2008-: elected member of the scientific council of the University of Avignon;

2008-11: member of the documentation Council of the University

2011-2017: member of the committee of experts in charge of the hiring in mathematics at the University Paris 11,

2013-:member of the scientific council of the FRUMAM (fédération de recherche mathématique de Marseille).

2013-: member of the council of the doctoral school Sciences & Agrosiences of Avignon University;

2013, 16: president of the committee in charge of the expertise of the Math departement of Valenciennes (LAMAV) and Brest-Vannes (LAMA) for the HCERES (high council in charge of the expertise of the research and the higher education) and member of other committees.

2014, 15, 16: deputy president of the committee of the French Research Agency in charge of the expertise of the research projets in Math and Theoretical computer science;

2014-: member of the scientific council of the French Mathematical Society;

2014-:member of the Council of the Math department;

2015-16: member of the scientific council of the National Institute of Mathematical Sciences and their Interactions (INSMI) of the CNRS;

2016-: responsible of the committee « short invitations of researchers » of Avignon University ;

Other evaluations:

- Israel Science Foundation, 2016.
- 2015: Padova University;
- 2008, 2011, 2013 expert for math departments for AERES;
- member of a lot of hiring committees;
- 2006-2008 : expert in my speciality at the Council of Burgundy.

Refereeing: Annal of Math, Inventiones Mathematica, Transactions of the AMS, Nonlinearity, Annales de la Faculté des Sciences de Toulouse, Ergodic Theory and Dynamical Systems, Communication in mathematical physics, Publicacions Matemàtiques, Mathematical Proceedings Cambridge Philosophical Society,Annales de l'Institut Fourier, Annales de l'ENS, Communications on Pure and Applied Mathematics, Math Z., DCDS A, Israel J. of Math., J. of differential geometry, Comptes-rendus de l'Académie des sciences, Annales Henri Poincaré, Annales de l'Institut Henri Poincaré/analyse non linéaire...

Invited conference lectures

1. Colloque de théorie ergodique et systèmes dynamiques, Institut Galilée, Villetaneuse, septembre 2001.
2. Colloque à la mémoire de Michel Herman, novembre 2002, IHP, Paris;
3. Colloque franco-brésilien en l'honneur de Harold Rosenberg, La Bussière, Septembre 2002;
4. Conference on variational methods for the N-body problem, Palo Alto, USA, juin 2003;
5. Workshop on the mathematical aspects of celestial mechanics, 12-20 décembre 2007, IHP, Paris;
6. Progress in Dynamics (pour les 65 ans d'Anatole Katok), 25-29 novembre 2009, IHP, Paris;
7. Colloque fondateur de l'Institut franco-uruguayen de mathématiques, 8-11 décembre 2009, Punta del Este, Uruguay;
8. International Conference on Dynamical Systems, celebrating the 70th anniversary of Jacob Palis, 24 février-5 mars 2010, Buzios, Brésil;
9. Conference on celestial mechanics and Hamiltonian systems, 15-18 avril 2010, université du Maryland, USA;
10. Congrès international des Mathématiciens (ICM), août 2010, Hyderabad, Inde;
11. Calibrations and laminations, 16-18 juin 2011, Freiburg, Allemagne;
12. Nanjing conference on Hamiltonian Dynamics, 21-28 août 2011, Nanjing, Chine;
13. Weak KAM theory in Italy, 12-17 septembre 2011, Cortona, Italie;
14. Conference Dynamical Optimization in PDE and geometry, Applications to Hamilton-Jacobi, Ergodic Optimization, Weak KAM, Bordeaux, December 12-21 2011;
15. Conference Recent Progress in Lagrangian and Hamiltonian Dynamics, a conference in honor of John Norman Mather's 70th Birthday, ENS Lyon, 4-9 June 2012;
16. Dynamique et EDP, CIRM (Marseille) 12-16 Novembre 2012;
17. Colloque Henri Poincaré, du mathématicien au physicien, Institut Henri Poincaré, Paris, du 19 au 23 novembre 2012 ;
18. Oberwolfach workshop "Dynamical Systems" (Allemagne) du 7 au 13 juillet 2013;
19. Workshop on Conservative Dynamics and Symplectic Geometry du 2 au 6 septembre 2013, IMPA (Rio de Janeiro);
20. C^0 -symplectic topology and dynamical systems , january 20-24 2014, IBS center for geometry and physics, campus of Postech, Pohang, Korea;
21. Workshop in Ergodic Theory and Dynamical Systems at the Department of Mathematics UNC Chapel Hill on Thursday, Friday, Saturday, and Sunday April 03-April 06, 2014;
22. Hamiltonian perturbation theory: separatrix splitting, theory and applications, May 5-9 2014, centro di ricerca matematica Ennio De Giorgi, Pisa, Italy;
23. ICM 2014 satellite conference on Dynamical Systems and Related Topics at Chungnam National University, Daejeon, Korea, August 8-12 2014;
24. Hamiltonian Dynamical Systems at Fudan University in Shanghai from January 4 to January 10, 2015;
25. 1st Korean-French Conference in Mathematics in POSTECH, Pohang in Korea du 24 au 28 août 2015;
26. Colloque Systèmes dynamiques et problèmes d'évolution du lundi 21 mars au vendredi 25 mars 2016 au CIRM à Marseille;
27. Rencontre entre Mathématiciens et physiciens théoriciens à Strasbourg les 2-3-4 juin 2016;
28. Conférencière plénière au premier congrès de la SMF à Tours du 6 au 10 juin 2016 ;
29. Dynamics Beyond Uniform Hyperbolicity du 5 au 16 juin 2017 à Provo, Utah, USA.

- 30. Workshop Dynamische Systeme à Oberwolfach du 9 au 15 juillet 2017;
- 31. Hamiltonian systems at the Conference Centro Stefano Franscini in Ascona, Switzerland from October 29 to November 3, 2017

Invitations in other universities

- may 1999: UCLA (USA), visiting Lai-Sang Young & Ricardo Perez-Marc
- may 2010: Maryland university (USA), visiting Vadim Kaloshin;
- january 2014: Nanjing University (China) visiting Chong-Qing Cheng;
- may 2016: University of Chicago visiting Jinxin Xue;
- april 2017: normal Beijing University, visiting Xifeng Su.

Talks in national seminars

- 10 janvier 2007: exposé au séminaire de théorie ergodique et systèmes dynamiques au LAGA à Paris 13.
- 15 janvier 2007: exposé au séminaire d'algèbre, dynamique et topologie du LATP à Marseille;
- 4 mai 2007: exposé au séminaire Symplect'X à l'école polytechnique;
- 9 mai 2007: exposé au séminaire de Mathématiques pures à l'ENS Lyon;
- 14 mars 2008: exposé au séminaire de systèmes dynamiques de l'Institut Mathématique de Jussieu;
- 30 mars 2009 : exposé au groupe de travail de théorie ergodique de l'Université Paris 11 (Orsay);
- 4 juin 2009 : exposé à Nice;
- 4 juin 2010: exposé au Séminaire joint Symplect' X de l'école polytechnique et dynamique hamiltonienne de l'institut mathématiques de Jussieu;
- 24 Septembre 2010: exposé au Séminaire Gaston Darboux à Montpellier;
- 6 décembre 2010: exposé à Ouessant dans le cadre d'une rencontre de l'ANR DynNonHyp;
- 9 mars 2011: exposé au Differential Geometry Seminar au DPMMS de l'université de Cambridge;
- 28 avril 2011: exposé au Séminaire de géométrie, topologie et dynamique d'Orsay;
- 4 Decembre 2012; séminaire de Physique Mathématiques à Lille;
- 20 Decembre 2012; séminaire de Théorie Spectrale et géométrie à Grenoble;
- 11 avril 2013; colloquium et séminaire d'analyse à Nantes;
- 19 février 2014; exposé à l'ENS Lyon;
- 13 octobre 2014: colloquium à Orsay;
- 5 novembre 2014: séminaire de théorie ergodique et systèmes dynamiques au LAGA (Villetaneuse);
- 8 janvier 2016: exposé lors de l'après-midi dynamique des universités Paris 7 et Paris 13;
- avril 2016: exposé à l'université de Chicago;
- may 2017: Beijing Normal University
- 12 september 2017: Amiens

Research grants awarded

2009-12: member of the ANR DynNonHyp project

2008-16: member of the weak KAM ANR project, member of the scientific committee;

2013-18: grant of the Institut universitaire de France: geometric and analytic inequalities for invariants by symplectic dynamics.

2016-: member of the MathAmSud SIDIHAM project (Hamiltonian Dynamical Systems, Celestial Mechanics, Weak KAM Theory) France-Chili-Uruguay (scientific coordinator: Andrea Venturelli).

Research students

2005-09: Marie Girard. (Avignon) PhD On the curves that are invariant by a C^1 generic symplectic diffeomorphism of a surface.

2012: Marie Lhuissier (ENS Lyon) 1st year Master thesis on Aubry-Mather theory;

2012: Matthias Pigneur (Paris 6) Master thesis on a demonstration on a multidimensional Birkhoff theorem;

2012-13: Matthias Pigneur, one year PhD on the sub-manifolds that are invariant by a symplectic dynamics;

2016: Ahmad Darwich (Aix-Marseille) Master thesis on the Lyapunov exponents (with Andrea Venturelli);

2016-: Anna Florio. PhD Maslov asymptotic index (with Andrea Venturelli).

PhD theses examined:

december 2000 : Ezequiel Maderna, advisor A. Fathi (ENS Lyon), On the symmetries of Lagrangian systems (referee).

july 2005 : Thérèse Vivier, advisor C. Bonatti (Dijon) , On the C^1 robustly transitive dynamics on the compact manifolds (referee).

december 2008 : Olivier Jaulent, advisor P. Le Calvez (Paris 13), On the geometrically minimizing orbits of twist maps (referee).

december 2011: Joanna Oliveira dos Santos, advisor Patrick Bernard (Paris Dauphine): Aubry-Mather theory, a geometric glance (referee).

may 2012: Clara Rossi, advisor Thierry Barbot (Avignon): Globally hyperbolic conformally flat time spaces.

september 2012: Mostapha Benhenda, advisor Bassam Fayad (Paris 13) : estimates for the conjugation of circle diffeomorphisms to rotations. Successive conjugations end differentiable realizations.

11 mars 2013: Vito Mandorino, advisor Patrick Bernard (Paris Dauphine); weak KAM theory and instabilities for families of Hamiltonians (referee).

30 mai 2013: Qiaoling Wei, advisors Marc Chaperon & Alain Chenciner (Paris 7): Viscosity solutions of the Solutions de viscosité des équations de Hamilton-Jacobi and minmax itérés;

20 juin 2013: Mehdi Belraouti, advisor Thierry Barbot (Avignon): Asymptotic convergence of the quasi-concave time levels in a constant curvature time space;

mai 2016: Xiaodong Wang, advisors Sylvain Crovisier & Lan Wen, Pekin-Orsay ; non hyperbolic chain recurrence classes for C^1 diffeomorphisms (referee).

7 december 2016: Olga Romaskevich, advisors Etienne Ghys- Yulij Ilyashenko (ENS Lyon-Moscou), Dynamics of physical systems, normal forms and Markov chains.

22 june 2017: Angel Pardo, advisor Pascal Hubert (Aix-Marseille), Asymptotic of the number of periodic orbits in the Model wind tree.

30 june 2017: Valentine Roos, advisor Patrick Bernard (ENS Paris), Variational and viscosity solutions of the Hamilton-Jacobi-Equation

Habilitations examined:

january 2011: Daniel Massart, Montpellier 2, on the Lagrangian systems and the beta function of Mather

december 2011: Barbara Schapira, Amiens: Geodesics, horocycles, and their invariant measures

december 2013: Gioia Vago, University of Burgundy: on the geometrical and combinatoric aspects in dynamical systems.

november 2014: Nicolas Bedaride (Aix-Marseille): substitutions piecewise isometries

november 2015: Samuel Petite (Amiens): Actions on a Cantor set: from symbolic dynamics to quasicrystals. symbolique aux quasi-cristaux

december 2015: Frederic Naud (Avignon): Spectral analysis of transfert operators and resonances

april 2016: Irene Passeron (history of mathematics, Paris 6) D'Alembert

dans son temps: editer la vie scientifique en France au 18e siecle,

2017: Vincent Humiliere (Paris 6): C^0 symplectic geometry and action selectors (referee).

Minicourses

- **december 2007**: 7 hours mini-course on my work in "workshop on the mathematical aspects of celestial mechanics "; Institut Henri Poincaré, Paris
- **january 2015**: 6 hours mini-course at Nanjing University the invariant sub-manifolds for multidimensional twists;
- **may 2015**: 8 hours mini-course at l'IHP and Collège de France on twist maps;
- **March 2015**: 4 hours mini-course at CIMPA school " Hamiltonian and Lagrangian Dynamics " in Salto, Uruguay on the Lyapunov exponents for the Aubry-Mather measures of twists.

Scientific Popularisation

- 2010: a paper in the Gazette of Mathematicians of the talk of Villani in Avignon for 700 high school students
- December 2012: with Patrick Massot, a paper on the website Images des maths: « Poincaré's annulus » that gave a chapter of the book Dynamical with Poincaré coordinated by A. Alvarez, Ed. Pommier
- 21 novembre 2011: talk at the day organized by the French Mathematical Society for the Bachelor students of Mathematics at rennes 1 University "Mathematicians rewarded at the Academy Sciences"
- Talks in different high schools
- october 2011: animation on friezes and tilings for the fest of science.
- Août 2012: one plenary and one parallel talk on Birkhoff's billiard at International Summer School of Mathematics for Young Students 2012 à l'ENS Lyon (for youth between 16 and 19).
- november 2009, december 2010, december 2012 : presentatie of the job of researcher in Math for high school students.
- march 2013: MidiSciences in Avignon: popularization talk on the work of Poincaré and the celestial mechanics;
- 2011-16 referent for the communication of the math department
- 2015,16, 17: reception of some high school students in the department
- 2015-16, 2016-17 and 2017-18: animation with Thérèse Falliero of a « atelier Math en jeans » ;
- one paper Raconte-moi...K.A.M, in the gazette des mathématiciens de la SMF 149 (2016).
- a talk in february 2016 at the National Library of France (BNF) in the cycle « un texte, un mathématicien » around the article « Is the solar system stable? » by Jürgen Moser.
- octobre 2016 et 2013: animation around fractales for the fest of science
- 2017: member of the committee of the junior concourse organized by the French Mathematical society;

Publications

[1] Type des points fixes des difféomorphismes symplectiques de $T^n \times \mathbb{R}^n$, *Supplément au Bull. Soc. Math. Fr.* **48** (1992)

[2] Type of critical points of Hamiltonian functions and of fixed points of symplectic diffeomorphisms, *Nonlinearity* **7** (1994) 1281-1290.

[3] Création de points périodiques de tous types au voisinage des tores K.A.M, *Bull. Soc.*

Math. France **123** (1995) 591-603.

[4] Un lemme de fermeture d'orbites: le "orbit closing lemma", *C.R. Acad. Sci. Paris série I* **323** (1996) 1175-1178.

[5] On the type of certain periodic orbits minimizing the Lagrangian action, *Nonlinearity* **11** (1998) 143-150.

[6] Le "Closing Lemma" en topologie C^1 , *Supplément au Bull. Soc. Math. Fr.* **74**(1998)

[7] Créations de connexions en topologie C^1 pour les flots des surfaces, *Bol. Soc. Mat. (N.S.)* **30** (1999) 335-366.

[8] Existence d'orbites périodiques complètement elliptiques sur des hypersurfaces convexes présentant certaines symétries, *C.R. Acad. Sci. Paris série I* **328** (1999) 1035-1038.

[9] Création de connexions en topologie C^1 , *C.R. Acad. Sci. Paris série I* **329** (1999) 211-214.

[10] Difféomorphismes de classe C^1 en dimension 4, *C.R. Acad. Sci. Paris série I* **331** (2000) 1001-1004.

[11] Création de connexions en topologie C^1 , *Erg. Th. & Dyn. Sys.* **21** (2001) 339-381.

[12] The generic symplectic C^1 diffeomorphisms of 4-dimensional symplectic manifolds are hyperbolic, partially hyperbolic or have a completely elliptic periodic point, *Erg. Th. & Dyn. Sys.* **22** (2002) 1621-1639.

[13] The 2-link periodic periodic orbits which maximize or minimize the length of a p -dimensional billiard are hyperbolic, *Nonlinearity* **15** (2002) 1755-1758

[14] Approximation des ensembles omega-limites des difféomorphismes par des orbites périodiques, *Ann. Sci. Ecole Norm. Sup. (4)* **36** (2003), no 2, 173-190

[15] avec Christian Bonatti et Sylvain Crovisier. Dynamiques symplectiques génériques, *Erg. Th. & Dyn. Sys.* **25** (2005) 1401-1436

[16] Convergence of the semi-group of Lax-Oleinik: a geometric point of view, *Nonlinearity* **18** (2005)

[17] Type des orbites périodiques des flots associés à des lagrangiens optiques homogènes, *Bull. Braz. Math. Soc.* **37**(2) (2006) 153-190

[18] Hyperbolic periodic orbits and Mather sets in certain symmetric cases, *Erg. Th. & Dyn. Sys.* **26** (2006) 939-959.

[19] The tiered Aubry set for autonomous Lagrangian functions, *Annales de l'Institut Fourier* **58**(5) (2008) 1733-1759

[20] Fibrés de Green et régularité des graphes C^0 -lagrangiens invariants par un flot de Tonelli, *Annales Henri Poincaré* **9** (5) (2008), 881-926

[21] Three results on the regularity of the curves that are invariant by an exact symplectic twist map, *Publ. Math. Inst. Hautes Etudes Sci.* 109, 1-17(2009)

[22] On a theorem due to Birkhoff, *Geometric and Functional Analysis: Volume 20, Issue 6* (2010), Pages 1307-1316.

[23] Green bundles and related topics, *Proceedings of the International Congress of Mathematicians, Hyderabad, India, 2010*

[24] The link between the shape of the Aubry-Mather sets and their Lyapunov exponents, *Annals of Mathematics*, Volume 174, Issue 3, November 2011, 1571-1601

[25] Pseudographs and Lax-Oleinik semi-group: a geometric and dynamical interpretation, *Nonlinearity* 24 (2011) 71-78

[26] A particular minimization property implies C^0 -integrability, *J. Differential Equations* 250 (2011), 2389-2401

[27] A non-differentiable essential irrational invariant curve for a C^1 symplectic twist map, *Journal of modern Dynamics*, vol. 5, no 3, (2011) 583 - 591 [30] Boundaries of instability zones for symplectic twist maps, *Journal of the Institute of Mathematics of Jussieu*, volume 13 (2013), issue 01, pp. 19-41.

- [28] Green bundles, Lyapunov exponents and regularity along the supports of the minimizing measures, *Annales de l'Institut Henri Poincaré / Analyse non linéaire* 29 (2012), pp. 989-1007
- [29] Boundaries of instability zones for symplectic twist maps, *Journal of the Institute of Mathematics of Jussieu*, volume 13 (2013), issue 01, pp. 19-41.
- [30] Lower and upper bounds for the Lyapunov exponents of twisting dynamics: a relationship between the exponents and the angle of the Oseledec's splitting, *Ergodic Theory and Dynamical Systems*, volume 33, issue 03, (2013), pp. 693-712
- [31] C^1 -generic billiard tables have a dense set of periodic points, special issue of *Regular and Chaotic Dynamics* dedicated to the Alain Chenciner's 70th birthday, Volume 18, Issue 6 of 2013
- [32] When are the invariant submanifolds of symplectic Dynamics Lagrangian?, *DCDS-A* (Vol. 34, No. 5) May 2014
- [33] Rigidity in topology C^0 of the Poisson bracket for Tonelli Hamiltonians, *Nonlinearity* 28 (2015) 2731-2742
- [34] avec Marc Arcostanzo, Philippe Bolle et Maxime Zavidovique. Tonelli Hamiltonians without conjugate points and C^0 integrability, *Mathematische Zeitschrift*, volume 280 n1-2 (2015) p165-194
- [35] Lyapunov exponents of minimizing measures for globally positive diffeomorphisms in all dimensions, *Communications in Mathematical Physics*, 343(3), 783-810 (2016).
- [36] avec Pierre Berger. The non-hyperbolicity of irrational invariant curves for twist maps and all that follows, *Revista Matemática Iberoamericana* number 32.4 (2016), pp. 1295-1310
- [37] Hyperbolicity for conservative twist maps of the 2-dimensional annulus, notes du minicours donné à Salto, Uruguay, *Publicaciones Matemáticas del Uruguay* n 16 (2016), 1-19.
- [38] Lyapunov exponents for conservative twisting dynamics: a survey. Proceedings du Ergodic theory workshop de l'université de Chapel Hill chez Walter de Gruyter. *Ergodic theory* p108-133, De Gruyter, Berlin 2016
- [39] avec Patrice Le Calvez. A notion of Denjoy sub-system. En ligne sur le site des comptes-rendus mathématiques depuis juillet 2017: <http://www.sciencedirect.com/science/article/pii/S1631073X17301991>
- [40] avec Andrea Venturelli. A multidimensional Birkhoff theorem for time-dependent Tonelli Hamiltonians. [hal-01309652](https://hal.archives-ouvertes.fr/hal-01309652) a paraître à *Calculus of Variations and PDE's*
- [41] avec Jinxin Xue. A C^1 Arnol'd-Liouville theorem. [hal-01422530](https://hal.archives-ouvertes.fr/hal-01422530)