

**Canadian Status:** Permanent Resident  
**Email:** aristide.baratin@umontreal.ca

**Citizenship:** French  
**Google Scholar Profile**

## Education

<b>Mila, Université de Montréal</b> Ph.D (machine learning) Advisor: <i>Simon Lacoste-Julien</i>	09/2017 - present
<b>Ecole Normale Supérieure (ENS), Lyon</b> & <b>Perimeter Institute</b> , Waterloo Ph.D (theoretical physics) Advisor: <i>Laurent Freidel</i>	01/2009
<b>Université Paris-Saclay &amp; ENS Paris</b> Master's degrees (mathematics & physics)	2002-2004
<b>ENS Paris-Saclay</b> Stipendiary student (mathematics) Admission by competitive examination (national rank: 6th)	2002-2004

## Academic Employment

<b>Visiting Fellow</b> McGill University, Dept of Mathematics and Statistics	2015 – 2017
<b>Humboldt Research Fellow</b> Host: University of Waterloo, Dept of Applied Mathematics	2013 – 2016
<b>Junior Scientist</b> Max Planck Institute for Gravitational Physics, Potsdam.	2008 – 2013

## Internships

<b>Microsoft Research</b> , Montréal Host: Romain Laroche	06/2021–09/2021
<b>Microsoft Research</b> , Montréal Host: Alessandro Sordoni	06/2020–09/2020
<b>Microsoft Research</b> , Montréal Host: Devon R. Hjelm	09/2019–12/2019
<b>Element AI</b> , Montréal (part time) Host: Negar Rostamzadeh	02/2018–07/2018

## Teaching Experience

### Lecturing at undergraduate level:

**Teaching Assistant/Supply Lecturer** Fall 2018  
DIRO, Université de Montréal  
Fundamentals of Algorithmics (Lecturer: Gilles Brassard)

**Course Lecturer (6 semester courses)** Sept 2015 - Aug 2017  
McGill University, Dept of Mathematics and Statistics  
Linear Algebra, General Algebra

**Course Lecturer (3 semester courses)** Sept 2013 - Aug 2015  
University of Waterloo, Dept of Applied Mathematics  
Calculus, Algebra

### Lecturing at graduate level:

**Teaching Assistant/Supply Lecturer** Fall 2005  
ENS Lyon, mathematics department.  
Course: Integration and Fourier theory (Lecturer: Cedric Villani).

**Teaching Assistant** 2004-2007  
ENS, physics department.  
Assistant and mentor for the training program 'Agrégation' in physics.  
(competitive examination for positions in public secondary education system).

## Honors and Awards

**Alexander Graham Bell Scholarship** May 2019  
Awarded by NSERC (Canada).

**Feodor Lynen Research Fellowship** June 2013  
Awarded by the A.v. Humboldt Foundation (Germany).

**ANR Research Grant (240,000 Euros)** June 2013  
Awarded by Agence Nationale de la Recherche (France)  
to build a research team (Postdoc-Return Program)  
I **declined** the offer to take the Feodor Lynen Fellowship

**Max Planck Postdoctoral Fellowship** Dec. 2008  
Awarded by the Max Planck Society.

**Government of Canada Award** Sept. 2005  
Research scholarship awarded by the Government of Canada.

**French Olympiads in Philosophy Essays.** 1997  
National rank: 1st.

## Publications (also available on arXiv and Google Scholar)

### Machine learning / AI

#### Conference publications (peer reviewed)

23. **A. Baratin\***, T. George\*, C. Laurent, R Devon Hjelm, G. Lajoie, P. Vincent, S. Lacoste-Julien. Implicit Regularization via Neural Feature Alignment. AISTATS 2021. Available as arXiv:2008.00938.
22. N. Rahaman\*, **A. Baratin\***, D. Arpit, F. Draxler, M. Lin, F. A. Hamprecht, Y. Bengio, A. Courville. On the Spectral Bias of Deep Neural Networks. ICML 2019. Available as arXiv:1806.08734.
21. I. Belghazi, **A. Baratin**, S. Rajeswar, S. Ozair, Y. Bengio, A. Courville, R Devon Hjelm. MINE: Mutual Information Neural Estimation. ICML 2018. Available as arXiv:1801.04062.

#### Preprints & workshop papers

20. J. Vuckovic, **A. Baratin**, R. Tachet des Combes. On the Regularity of Attention. Available as arXiv:2102.05628. *Note: this is a conference version of arXiv:2007.02876.*
19. J. Vuckovic, **A. Baratin**, R. Tachet des Combes. A Mathematical Theory of Attention. Available as arXiv:2007.02876.
18. **A. Baratin**, T. George, C. Laurent, R Devon Hjelm, G. Lajoie, P. Vincent, S. Lacoste-Julien. Implicit Regularization in Deep Learning: a View from Function Space. Presented at the 'Machine learning with guarantees' and 'Science meet Engineering' workshops, NeurIPS 2019.
17. B. Neal, S. Mittal, **A. Baratin**, V. Tantia, M. Scicluna, S. Lacoste-Julien, I. Mitliagkas. A Modern Take on the Bias-Variance Tradeoff in Neural Networks. Available as arXiv:1810.08591.
16. A. Erraqabi\*, **A. Baratin\*** Y. Bengio, S. Lacoste-Julien. A3T: Adversarially Augmented Adversarial Training. Machine Deception Workshop, NIPS 2017. Available as arXiv:1801.04055.
15. **A. Baratin\***, S. Tan\*, P-A Brousseau, A. Goyal, A. Lamb. Exploring Machine Learning for Particle Physics. Technical report, 2017. Available at this URL.

### Theoretical Physics

#### Journal publications

14. **A. Baratin**, L. Freidel (2015). A 2-categorical state sum model. Journal of Mathematical Physics 56, 011705.
13. **A. Baratin**, L. Freidel and R. Gurau (2014). Weighting bubbles in group field theory. Physical Review D 90, 024069.
12. **A. Baratin**, S. Carrozza, D. Oriti, J. Ryan, M. Smerlak (2014). Melonic phase transition in group field theory. Letters in Mathematical Physics 104 8, 1003-1017.
11. J.C Baez, **A. Baratin**, L. Freidel, D. Wise (2012). Infinite Dimensional Representations of 2-Groups. Memoirs of the American Mathematical Society 219, No.1032 (120 pages).
10. **A. Baratin**, D. Oriti (2012). Group field theory and simplicial gravity path integrals: A model for Holst-Plebanski gravity. Physical Review D 85, 044003.
9. **A. Baratin**, C. Flori, T. Thiemann (2012). The Holst Spin Foam Model via Cubulations. New Journal of Physics 14, 103054.
8. **A. Baratin**, D. Oriti (2011) Quantum simplicial geometry in the group field theory formalism: re-considering the Barrett-Crane model. New Journal of Physics 13, 125011.

7. **A.Baratin**, F.Girelli, D.Oriti (2011). Diffeomorphisms in group field theories. Physical Review D83, 104051.
6. **A.Baratin**, B.Dittrich and J.Tambornino (2011), Non-commutative flux representation for loop quantum gravity. Classical Quantum Gravity 28, 175011
5. **A.Baratin**, D.Oriti (2010) , Group field theory with non-commutative metric variables. Physical Review Letter 105, 221302.
4. **A.Baratin**, L.Freidel (2007). Hidden quantum gravity in 4d Feynman diagrams: Emergence of spin foams. Classical and Quantum Gravity 24, 2027-2060
3. **A.Baratin**, L.Freidel (2007). Hidden quantum gravity in 3d Feynman diagrams. Classical and Quantum Gravity 24 , 1993-2026.

#### **Conference proceedings**

2. **A.Baratin**, D.Oriti (2012). Ten questions on group field theory (and their tentative answers). J. Phys.: Conf. Ser. 360, 012002.
1. **A.Baratin**, D.Wise (2009). 2-group representations for spin foams. AIP Conf. Proc.1196, 28-35

## **Invited Conference Talks (Selection)**

### Machine learning Conferences

**July 2019:** Theoretical Advances in Deep Learning Workshop.  
Istanbul Center for Mathematical Sciences, Turkey.  
Talk: Implicit bias in deep learning: a view from function space.

**Jan 2019:** Theoretical Physics for Machine Learning Conference.  
Aspen, Colorado.  
Talk: On the spectral bias of neural networks.

### Mathematics & Physics Conferences

**July 2015:** Invited to Loops '15 as plenary speaker.  
Friedrich-Alexander University, Erlangen, Germany

**July 2014:** 2014 CAP Congress  
Laurentian University, Sudbury, Ontario

**March 2013:** "Quantum Gravity in Paris"  
Orsay University

**Sept. 2012:** "Recent Advances in Topological Quantum Field Theories"  
University of Lisbon.

**July 2012:** "3Quantum: Algebra Geometry Information"  
Tallinn University of Technology.

**March 2012:** "Quantum Gravity in Paris"  
Orsay University, Paris 7 University

**Nov. 2011:** “Categories and Physics”  
Paris 7 University

**Nov. 2011** “Renormalization: algebraic, analytic and geometric aspects”  
Institut Poincaré, Paris.

**May 2011** “Higher Gauge Theory, TQFTs, and Categorification”  
School of Mathematics, Cardiff University

**March 2011:** “Quantum space-time: from discreteness to continuum”  
Orsay University

**March 2011:** “Mathematical, Physical and Conceptual aspects of Quantum Gravity”  
Paris 7 University

**Feb. 2011** “Higher Gauge Theory, TQFT and Quantum Gravity”  
Instituto Superior Técnico, Lisbon.

**Oct 2010:** Quantum Gravity Colloquium 5  
Paris 7 University

**March 2010:** “Loops and foams”  
Zakopane, Poland.

## Referees

### Theoretical Physics

**John C. Baez**  
University of California, Riverside  
baez@math.ucr.edu

**Laurent Freidel**  
Perimeter Institute, Waterloo  
lfreidel@perimeterinstitute.ca

**Daniele Oriti**  
LMU, München  
daniele.oriti@gmail.com

### Machine Learning

**Aaron Courville**  
Université de Montréal  
aaron.courville@gmail.com

**Guillaume Lajoie**  
Université de Montréal  
g.lajoie@umontreal.ca

**Simon Lacoste-Julien**  
Université de Montréal  
slacoste@iro.umontreal.ca