

# MIKOŁAJ JAKUB KASPRZAK

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## Academic work experience and education

- 01/12/2022- **Incoming phase of the Marie Skłodowska-Curie Global Fellowship, Department of Mathematics, University of Luxembourg**
- Working independently on topics related to Bayesian inference and probability theory
- 01/09/2022-30/11/2022 **Secondment under the Marie Skłodowska-Curie Fellowship, Gatsby Unit for Computational Neuroscience, University College London (UCL)**
- Working in the group of Professor Arthur Gretton
  - Carrying out research in topics related to kernel methods in machine learning
- 01/09/2021-31/08/2022 **Outgoing phase of the Marie Skłodowska-Curie Global Fellowship, Laboratory for Information and Decision Systems, Massachusetts Institute of Technology (MIT)**
- Working in the group of Professor Tamara Broderick
  - Carrying out research in various areas of mathematical statistics and machine learning with an emphasis on Bayesian methods
- 01/12/2018-31/08/2021 **Postdoctoral Research Associate, Department of Mathematics, University of Luxembourg**
- Working in the group of Professor Giovanni Peccati
  - Carrying out research in various areas of modern probability with an emphasis on probabilistic approximations
- 01/10/2015-26/02/2019 **Doctor of Philosophy (DPhil) in Statistics, University of Oxford**
- Research project : "Stein's method for functional approximation" (supervisor: Professor Gesine Reinert)
  - Academic Interests: Probability Theory, Applied Probability, Mathematical Statistics
- 01/10/2011-30/06/2015 **BSc, Master of Mathematics, Operational Research, Statistics and Economics (with Honours), University of Warwick**
- First Class (89.9% overall)
  - Second best final result in the 2015-2019 cohort of students
  - Dissertation: "Erdős-Kac Theorem and Mod-Poisson Convergence" (Supervisor: Dr Jon Warren)

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## Publications and accepted articles

\*authors listed in the alphabetical order, as is customary in pure mathematics

- 2022 **M. J. Kasprzak\***, G. Peccati\*: *Vector-valued statistics of binomial processes: Berry-Esseen bounds in the convex distance*, **Annals of Applied Probability**, accepted (arXiv:2203.13137)
- 10/2022 Ch. Döbler\*, **M. J. Kasprzak\***, G. Peccati\*. *The Multivariate Functional De Jong CLT*, **Probability Theory and Related Fields**, 184(1): 367-399, 2022 (arXiv:2104.01858)
- 02/2022 Ch. Döbler\*, **M. J. Kasprzak\***, G. Peccati\*. *Functional Convergence of U-processes with Size-Dependent Kernels*, **Annals of Applied Probability** 32(1): 551-601, 2022 (arXiv:1912.02705)
- 05/2021 Ch. Döbler\*, **M. J. Kasprzak\***: *Stein's method of exchangeable pairs in multivariate functional approximations*, **Electronic Journal of Probability** 26:1-50, 2021 (arXiv:2005.12733)

- 11/2020 **M. J. Kasprzak.** *Functional approximations with Stein's method of exchangeable pairs*, **Annales de l'Institut Henri Poincaré, Probabilités et Statistiques** 56(4):2540-564, 2020 (arXiv:1710.09263)
- 08/2020 **M. J. Kasprzak.** *Stein's method for multivariate Brownian approximations of sums under dependence*, **Stochastic Processes and their Applications** 130(8):4927-4967, 2020 (arXiv:1708.02521)
- 08/2020 J. H. Huggins, **M. J. Kasprzak**, T. Campbell, T. Broderick. *Validated Variational Inference via Practical Posterior Error Bounds*, **Proc. of the 23rd International Conference on Artificial Intelligence and Statistics (AISTATS)**, PMLR 108:1792-1802, 2020 (arXiv:1910.04102)
- 04/2019 J. H. Huggins, T. Campbell, **M. J. Kasprzak**, T. Broderick. *Scalable Gaussian Process Inference with Finite-data Mean and Variance Guarantees*, **Proc. of the 22nd International Conference on Artificial Intelligence and Statistics (AISTATS)**, PMLR 89:796-805, 2019 (arXiv:1806.10234)
- 04/2017 **M. J. Kasprzak**, A. B. Duncan and S. J. Vollmer. *Note on A. Barbour's paper on Stein's method for diffusion approximations*, **Electronic Communications in Probability** 22 (2017), number 23 (arXiv:1702.03130)

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## Preprints

- 09/2022 **M. J. Kasprzak**, R. Giordano, T. Broderick: *How good is your Gaussian approximation of the posterior? Finite-sample computable error bounds for a variety of useful divergences* (arXiv:2209.14992)
- 06/2022 G. Wynne, **M. J. Kasprzak**, A. B. Duncan: *A Spectral Representation of Kernel Stein Discrepancy with Application to Goodness-of-Fit Tests for Measures on Infinite Dimensional Hilbert Spaces* (arXiv:2206.04552) - **major revision in Bernoulli**.

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## Miscellanea

- 2018 J. H. Huggins, **M. J. Kasprzak**, T. Campbell, T. Broderick. *Practical bounds on the error of Bayesian posterior approximations: A nonasymptotic approach* (arXiv:1809.09505)
- 2017 **M. J. Kasprzak.** *Diffusion approximations via Stein's method and time changes* (arXiv:1701.07633)

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## Major ongoing projects

*MCMC-biased diagnostics for Variational Inference* (with Yu Wang (Boston) and Jonathan Huggins (Boston)) - preprint coming up soon.

*A unified view of Bayesian posterior approximations* (with Jonathan Huggins (Boston), Yu Wang (Boston), Trevor Campbell (UBC) and Tamara Broderick (MIT))

*Quantitative functional convergence of stochastic gradient algorithms* (with Jeffrey Negrea (Chicago), Solesne Bourguin (Boston) and Jonathan Huggins (Boston))

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## Funding, scholarships and awards

- 09/2021-11/2023 **Marie Skłodowska-Curie Individual (Global) Fellowship** (individual grant sponsored by the European Research Executive Agency, 186 000 EUR):  
*Stein-ML: Stein's method and functional inequalities in machine learning*
- 07/2020-03/2021 *Named collaborator* on the ABMLux project aiming to build an agent-based model for the spread of an epidemic in Luxembourg (FNR COVID-19 Grant, 50 000 EUR)
- 04/2019 Institute of Mathematical Statistics New Researcher Travel Award (1300 USD)
- 10/2015-03/2019 Engineering and Physical Sciences Research Council Full Doctoral Studentship

06/2012-  
06/2015 First Year Francis Edgeworth Prize, Second and Third Year Academic Excellence Prizes and Fourth Year MORSE Prize awarded in recognition of an outstanding performance in examinations at the University of Warwick

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## Scientific collaborators

Solesne Bourguin, *Boston University*  
Tamara Broderick, *Massachusetts Institute of Technology (MIT)*  
Trevor Campbell, *The University of British Columbia*  
Ryan Giordano, *Massachusetts Institute of Technology (MIT)*  
Christian Döbler, *University of Düsseldorf*  
Andrew Duncan, *Imperial College London*  
Jonathan Huggins, *Boston University*  
Jeffrey Negrea, *University of Chicago*  
Giovanni Peccati, *University of Luxembourg*  
Sebastian Vollmer, *University of Kaiserslautern*  
Yu Wang, *Boston University*  
George Wynne, *University of Bristol*

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## Invited talks

12/2022 **Meeting in Mathematical Statistics, CIRM Luminy, Marseille**  
"How good is your Laplace approximation? Finite-sample error bounds for a variety of useful divergences"

11/2022 **Mathematical Statistics seminar, Weierstrass Institute, Berlin**  
"How good is your Laplace approximation? Finite-sample error bounds for a variety of useful divergences"

11/2022 **Statistics seminar, Université Catholique de Louvain**  
"How good is your Laplace approximation? Finite-sample error bounds for a variety of useful divergences"

11/2022 **Research Seminar, Centre for Mathematical and Statistical Modelling, Brunel University London**  
"How good is your Laplace approximation? Finite-sample error bounds for a variety of useful divergences"

07/2022 **Bernoulli Society Young Researchers Event, online**  
"Theoretical guarantees for the quality of Laplace approximations in Bayesian Statistics"

06/2022 **Stein's Method: The Golden Anniversary, National University of Singapore**  
"How good is your Bayesian CLT? Error bounds for a variety of useful divergences."

04/2022 **Probability and Statistics Seminar, University of Manchester**  
"Stein's method and Gaussian process approximations"

09/2021 **Probability and Statistics Seminar, University of Boston**  
"Functional limit theorems via Stein's method"

12/2020 **13th International Conference of the ERCIM WG on Computational and Methodological Statistics, London**  
"Infinite-dimensional Stein's method with applications"

10/2020 **Statistics Seminar, Imperial College London**  
"Infinite-dimensional Stein's method with applications"

10/2020 **Barcelona Mathematical Days**  
"Functional approximations with Stein's method of exchangeable pairs"

09/2019 **Probability seminar, University of Luxembourg**  
"Scalable Gaussian Process Inference with Finite-data Mean and Variance Guarantees"

- 02/2018 **Markov processes on metric measure spaces and Gaussian fields workshop, University of Duisburg-Essen**  
"Diffusion approximations via time changes and Stein's method"
- 10/2017 **Probability Seminar, University of Liège**  
"Diffusion approximations via time changes and Stein's method"
- 11/2017 **Machine Learning Seminar, Gatsby Unit, University College London**  
"Functional approximations with Stein's method"
- 06/2017 **Probability Seminar, University of Luxembourg**  
"Diffusion approximations via time changes and Stein's method"
- 05/2017 **Informal Probability Workshop, University of Oxford**  
"Diffusion approximations via time changes and Stein's method"
- 10/2016 **Stein Workshop, University of Oxford**  
"Diffusion approximations via time changes and Stein's method"

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## Contributed talks

- 03/2023 **German Probability and Statistics Days, Essen**  
"How good is your Laplace approximation? Finite-sample error bounds for a variety of useful divergences"
- 07/2021 **10th Bernoulli-IMS World Congress in Probability and Statistics**  
"Functional limit theorems for U-statistics"
- 07/2019 **Stochastic Processes and Applications Conference, Evanston**  
"Functional approximations with Stein's method of exchangeable pairs"
- 06/2019 **12th International Conference on Bayesian Nonparametrics, Oxford**  
"Probabilistic methods for proving error bounds in GP posterior approximation"
- 06/2018 **Stochastic Processes and Applications Conference, Gothenburg**  
"Functional approximations via exchangeable pairs with applications to degenerate U-statistics"
- 07/2017 **Stochastic Processes and Applications conference, Moscow**  
"Functional approximations via Stein's method of exchangeable pairs"
- 07/2017 **Warsaw Summer School of Probability, University of Warsaw**  
"Diffusion approximations via time changes and Stein's method"
- 04/2017 **Oxford Junior Probability Seminar**  
"Diffusion approximations via time changes and Stein's method"
- 07/2016 **World Congress in Probability and Statistics, Toronto**  
"Stein's method for functional approximation"
- 06/2016 **Research Students Conference in Probability and Statistics, Dublin**  
"Stein's method for functional approximation"
- 04/2016 **Oxford Junior Probability Seminar**  
"Erdős-Kac Theorem and Mod-Poisson Convergence"

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## Research visits

- 11/2022 **Weierstrass Institute for Applied Analysis and Stochastics, Berlin**
  - Visiting Professor Vladimir Spokoiny
  - Working on problems in the area of Bayesian inference
- 11/2018 **Microsoft Research New England**
  - Visiting Dr Lester Mackey
  - Working on problems in the area of measuring MCMC sample quality with Stein's method and related techniques

- 10/2017 **University of Liège**
- Visiting the group of Professor Yvik Swan
  - Working on problems at the intersection of Stein's method and information theory
- 06/2017 **University of Luxembourg**
- Visiting the group of Professor Giovanni Peccati
  - Working on problems in the area of Stein's method of exchangeable pairs

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## Community service

- 2020-2022 **Reviewer** for *Annals of Applied Probability*, *Electronic Journal of Probability*, *Journal of Applied Probability*, *Brazilian Journal of Probability and Statistics*, *NeurIPS 2021*, *AISTATS 2021* and *AISTATS 2022*.
- 07/2021 **Co-organiser** of an invited paper session on Stein's method for machine learning at the ISI World Statistics Congress
- 04/2020-03/2021 **Member** of the *Statistical Projections* work package of the **COVID-19 Task Force** at the University of Luxembourg
- 09/2019-07/2021 **Organiser** of the statistical machine learning reading group at the Luxembourg University Department of Mathematics
- 01/2020-01/2021 **Member of the executive team** of *Luxembourg's young researchers association LuxDoc*

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## Teaching experience

- 01/2019-01/2021 **Department of Mathematics, University of Luxembourg**
- 2021: *Course co-leader and lecturer* for Markov Chains
  - 2020: *Exercise class tutor* for Analysis 1 at the Bachelor of Physics
  - 2019: *Exercise class tutor* for Functional Analysis and General Topology
- 01/2017-06/2018 **St. Hugh's College, University of Oxford**
- 2017/2018: *Non-stipendiary lecturer and tutor* for Probability
  - 2016/2017: *Tutor* for Statistics and Constructive Mathematics
- 10/2015-05/2017 **Department of Statistics and Department of Mathematics, University of Oxford**
- 2016/2017: *Class tutor* for Applied Probability and Probability and Statistics for Networks Analysis; *Consultation Class Tutor* for Martingales Through Measure Theory
  - 2015/2016: *Teaching Assistant* for Applied Probability and Continuous Martingales and Stochastic Calculus; *Consultation Class Tutor* for Martingales Through Measure Theory
- 10/2014-04/2015 **Department of Statistics, University of Warwick**
- *Supervisor* for 8 first-year students, teaching Analysis and Linear Algebra

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## Supervision experience

- 2021 **Department of Mathematics, University of Luxembourg**
- Co-supervisor of a Bachelor thesis on Markov Chain Monte Carlo (MCMC)

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## Other work experience

- 06/2018-08/2018 **Summer Associate, Statistical Modelling and Development, Barclays Investment Bank, UK**
- Working in the Fixed Income Systematic Market Making and algorithmic trading functions of the bank
- 06/2014-08/2014 **General Insurance Risk Actuarial Summer Intern, Allianz UK**
- Carrying out calculations and applying actuarial judgement necessary for capital modelling and estimating risk levels

06/2013-  
08/2013

**Pensions Actuarial Consulting Summer Intern, Aon Hewitt UK**

- Carrying out some standard actuarial calculations for scheme trustees and administrators; drafting reports, presentation slides and emails to clients; helping with preparation of training materials for scheme trustees

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**Additional skills**

**Languages:** *Polish*: mother tongue, *English*: fluent, *German*: working fluency (level B2), *French*: basic  
**IT Skills:** *Programming*: R, Python, Mathematica