

Charles Alexandre Bédard

C U R R I C U L U M V I T Æ

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Research Interests

My research links computer science and physics, with interests in quantum computing and information processing, quantum foundations, and algorithmic information theory. I have a growing interest in the theoretical challenges of deploying quantum communication networks.



Education

- 2014–2020 **PhD in Physics**, Université de Montréal.
- Thesis: *Algorithmic Information in Physics: Emergence, Sophistication and Quantum Locality*. Thesis awarded the distinction “exceptional”. [Available on Papyrus](#)
 - Supervisor: Gilles Brassard
 - External examiner: Charles H. Bennett
 - Admitted directly to the PhD from the bachelor’s program
- 2011–2013 **BSc in Mathematics and Physics**, Université de Montréal.
- Awarded a distinction of excellence; GPA: 4.2/4.3.
 - Student exchange at École polytechnique fédérale de Lausanne, Switzerland



Academic Appointments

- 2026–present **Senior Scientific Coordinator**, Gilles Brassard Institute for Fundamental Quantum Computing and Québec Network of Industrial Research Chairs in Quantum Communications.
- 2025–present **Postdoctoral researcher**, École de technologie supérieure (ÉTS).
- Supervisor: Claude Crépeau
 - Founder and organizer of the Séminaire quantique ÉTS
 - Organizer and host of quantum workshops and special events at ÉTS
- 2023–2024 **Academic visitor**, University of Oxford.
- Dual affiliation with the Department of Physics and the Faculty of Philosophy
 - Academic hosts: Vlatko Vedral and Christopher Timpson
- 2020–2024 **Postdoctoral researcher**, Faculty of Informatics, Università della Svizzera italiana.
- Supervisor: Stefan Wolf
 - Organizer and main speaker at the seminars on local quantum theory
 - Co-supervisor of two master’s theses
- 2019 **PhD internship**, Institute for Quantum Optics and Quantum Information (IQOQI), Vienna.
- Supervisor: Marcus Huber
 - Organization and delivery of seminars on computability theory
- 2011–2012 **Summer internships**, Centre de recherches mathématiques, Montréal.
- Investigations of exact solutions of the q-deformed quantum harmonic oscillator



Peer-Reviewed Articles

- 2025 Bédard, C. A. Explaining Bell Locally. *Proceedings of the Royal Society A* **481**, 20250553 (2025). [doi:10.1098/rspa.2025.0553](https://doi.org/10.1098/rspa.2025.0553).
- 2025 Bédard, C. A. On the Alleged Locality in the Schrödinger Picture. *Physics* **7**(2), 11 (2025). Comment on Vedral, V. Locality in the Schrödinger Picture of Quantum Mechanics. *Physics* **6**, 793–800 (2024). [doi:10.3390/physics7020011](https://doi.org/10.3390/physics7020011).
- 2025 Bédard, C. A., Berthelette, S., Coiteux-Roy, X. and Wolf, S. Temperature as Joules per Bit. *American Journal of Physics* **93**(5), 390–395 (2025). [doi:10.1119/5.0198820](https://doi.org/10.1119/5.0198820).
Research spotlight: Ikenson, B. *A bit better than a kelvin*. *Scilight*, AIP Publishing, 171103 (2025).
- 2024 Violaris, M., Rijavec, S. and Bédard, C. A. Quantum Teleportation Using a Genuinely Classical Communication Channel Must Fail. In *Proceedings of the 2024 IEEE International Conference on Quantum Computing and Engineering (QCE)*, vol. 2, 516–517 (2024). [doi:10.1109/QCE60285.2024.10383](https://doi.org/10.1109/QCE60285.2024.10383).
- 2023 Bédard, C. A. Teleportation Revealed. *Quantum Reports* **5**(2), 510–525 (2023). [doi:10.3390/quantum5020034](https://doi.org/10.3390/quantum5020034).
- 2022 Bédard, C. A. and Bergeron, G. An Algorithmic Approach to Emergence. *Entropy* **24**(7), 985 (2022). [doi:10.3390/e24070985](https://doi.org/10.3390/e24070985).
- 2021 Bédard, C. A. The Cost of Quantum Locality. *Proceedings of the Royal Society A* **477**(2246), 20200602 (2021). [doi:10.1098/rspa.2020.0602](https://doi.org/10.1098/rspa.2020.0602).
- 2021 Bédard, C. A. The ABC of Deutsch-Hayden Descriptors. *Quantum Reports* **3**(2), 272–285 (2021). [doi:10.3390/quantum3020017](https://doi.org/10.3390/quantum3020017).
- 2017 Baumeler, Ä., Bédard, C. A., Brassard, G. and Wolf, S. Kolmogorov Amplification from Bell Correlation. In *Proceedings of the IEEE International Symposium on Information Theory (ISIT)*, 1554–1558 (2017). [IEEE Xplore](https://doi.org/10.1109/ISIT.2017.8016688).



Book Chapters

- 2026 Bédard, C. A. Realism and the Inequivalence of the Two Quantum Pictures. In *Local Quantum Mechanics: Everett, Many Worlds, and Reality*, ed. Alyssa Ney, 289–309. Oxford University Press (2026). [doi:10.1093/9780197792766.003.0012](https://doi.org/10.1093/9780197792766.003.0012). [arXiv:2510.02138](https://arxiv.org/abs/2510.02138).
- 2026 Bédard, C. A. Another Triumph of Locality: Colliding Histories Skew Handshakes. In *Bold Conjectures, Volume II: Essays Across Physics*, ed. Logan Chipkin. Conjecture Press (2026). [arXiv:2604.05455](https://arxiv.org/abs/2604.05455).



Preprints and Manuscripts

- Bédard, C. A., Rijavec, S. and Violaris, M. Does Gravitational Teleportation Fail? Manuscript in preparation.
- Bédard, C. A., Berthelette, S., Coiteux-Roy, X. and Wolf, S. Non-probabilistic Statistical Mechanics. Manuscript in preparation.
- 2020 Bédard, C. A. Relativity of Depth and Sophistication. Preprint (2020); journal submission in preparation. [arXiv:2002.06709](https://arxiv.org/abs/2002.06709).



Teaching

- Spring 2023 **Lecturer**, Faculty of Informatics, Università della Svizzera italiana.
Developed and taught an original doctoral-level course in algorithmic information theory.
• [Course recorded and made available online](#)
• [Lecture notes](#)
- Winter 2019 **Lecturer**, Département de physique, Université de Montréal.
Mechanics and modern physics.
- Fall 2018 **Lecturer**, Département d'informatique et de recherche opérationnelle (DIRO), Université de Montréal.
Quantum information theory; a course normally taught by Gilles Brassard.
- Winter 2018 **Lecturer**, Département de physique, Université de Montréal.
Mechanics and modern physics.
- 2012–2017 **Teaching assistant**, Département de physique and DIRO, Université de Montréal.
Electromagnetism, quantum mechanics, mathematical physics and quantum information theory.



Graduate Supervision

- 2021 Co-supervisor, William Schober, *Geometry of Quantum State Space: An Investigation by Convexity and Unitary Orbits*, MSc thesis, Università della Svizzera italiana.
- 2021 Co-supervisor, Anita Buckley, *The Mathematics of Quantum Information Theory: Geometry of Quantum States*, MSc thesis, Università della Svizzera italiana.



Service

- 2026 Co-organizer, host and speaker, *Symposium Gilles Brassard*, Université de Montréal, Campus MIL, November 10–11, 2026 (forthcoming). [Event information](#).
- 2025–present Founder and organizer of the Séminaire quantique ÉTS, a continuing research seminar featuring local and international speakers. [Videos](#). [Past seminars and events](#).
- 2026 Co-organizer of *From Quanta to Qualia* and host of its public day. Five-day international workshop with the Foundational Questions Institute (FQxI), Montréal and Eastman, August 2026. Developed the program, recruited speakers and coordinated partners. [Conference website](#). [Public-day report](#).
- 2026 Organizer of *Tutorials on Local Approaches to Quantum Mechanics*, a one-day program of three invited tutorials at ÉTS, Montréal, Canada, August 2026. [Videos](#).
- 2026 Organizer and host of *Foundational Questions at ÉTS: From Quanta to Qualia*. ÉTS, Montréal, Canada, March 2026. Invited speakers: Ian Durham, Kelvin McQueen, Gilles Brassard, and Lucien Hardy. [Read more here](#).
- 2025–present Organizer and host or co-host of Atelier quantique ÉTS activities, including a three-part mini-course on Shannon information developed and delivered in summer 2025.
- 2025 Co-organizer of *Quantum 2025: A Year in Review*. ÉTS, Montréal, Canada, December 2025.
- 2025 Organizer of *The Unitary Day at ÉTS*. ÉTS, Montréal, Canada, May 2025. Invited speakers: Lev Vaidman and Simon Saunders. [Videos](#).

- 2023 Co-organizer of the event and website for David Deutsch's 70th birthday, with Artur Ekert, Chiara Marletto, and Samuel Kuypers. dd70th.weebly.com.
- 2021 Co-organizer of the international conference *On the Shoulders of Everett*, with Samuel Kuypers. everett2021.weebly.com.



Other Publications and Scholarly Contributions

- 2025 Bédard, C. A. The Nature of Computation, Incompleteness, and Mathematics. Interview with David Deutsch and Charles H. Bennett, published in *Bold Conjectures, Volume I: Select Interviews of David Deutsch*, edited by Logan Chipkin. Conjecture Press (2025).
- 2023 Bédard, C. A. Explanations as Programs? Contribution to the event organized in honour of David Deutsch's 70th birthday (2023). [Available on dd70th](#).
- 2023 Bédard, C. A. Bennett and Deutsch: The Nature of Computation, Incompleteness, and Mathematics, Lugano (June 2023). Recorded conversation with David Deutsch and Charles H. Bennett, which I moderated as part of my course on algorithmic information theory. [Available on YouTube](#).
- 2021 Bédard, C. A. Darwin's Simuniverses: A Wild Guess on the Origin of the Church–Turing–Deutsch Principle. *Cryptography and Quantum Information group blog* (2021). [Available on CQI blog](#).



Invited Conference Talks

- 2026 Factoring Entanglement: A Crash Course on Deutsch–Hayden Descriptors. *Tutorials on Local Approaches to Quantum Mechanics*, ÉTS, Montréal, Canada. [Available on YouTube](#).
- 2026 Fundamentally Classical Systems Cannot Locally Mediate Teleportation. *From Quanta to Qualia*, Eastman, Canada.
- 2026 Explaining Bell Locally. *Advances in Physics*, Conjecture Institute. [Available on YouTube](#).
- 2025 Causal Reasoning for Classical and Quantum Systems. *Quantum 2025: A Year in Review*, ÉTS, Montréal, Canada.
- 2025 Halting Information Separates Sophistication and Busy Beaver Depth. *Second Symposium on Algorithmic Information Theory and Machine Learning* (online), Imperial College London, London, UK. [Available on YouTube](#).
- 2025 Factoring Entanglement: A Crash Course on Deutsch–Hayden Descriptors. *The Unitary Day at ÉTS*, Montréal, Canada. [Available on YouTube](#).
- 2024 The Schrödinger and the Heisenberg Pictures are Realistically Inequivalent. *Workshop for the volume Local Quantum Mechanics: Everett, Many Worlds, and Reality*.
- 2024 Explaining Bell Locally. *Department of Physics Colloquium*, Université de Montréal, Montréal, Canada.
- 2022 Teleportation Revealed. *The MWI Research Workshop of the Israeli Science Foundation*, Tel Aviv, Israel. [Available on YouTube](#).
- 2021 Quantum Locality: Unification, Cost and Consequences. *On the Shoulders of Everett*. [Available on YouTube](#).



Invited Seminars

- 2026 Does Gravitational Teleportation Fail? Joint presentation with Simone Rijavec. *IQOQI Vienna Seminar*, Vienna, Austria.
- 2026 Locality in the Heisenberg Picture. *Invited seminar*, Freie Universität Berlin, Berlin, Germany.
- 2026 Does Gravitational Teleportation Fail? *Cryptography and Quantum Information Seminar*, Università della Svizzera italiana, Lugano, Switzerland.
- 2025 Explaining Bell Locally. *Quantum Information Society*, Oxford, UK.
- 2025 Factoring Entanglement: A Crash Course on Deutsch–Hayden Descriptors. *Quantum Information Theory Seminar*, Cornell University (online), Ithaca, NY, USA. [Available on YouTube](#).
- 2025 From Locality to Causality in the Heisenberg Picture. *Laboratory for Theoretical and Quantum Informatics Seminar*, Montréal, Canada.
- 2024 Bell from Everett and Heisenberg. *Università della Svizzera italiana*, Lugano, Switzerland.
- 2023 Unification of Local Formalisms with Speculations on Causal Structures. *University of Oxford, Department of Computer Science*, Oxford, UK.
- 2023 Empirical Tests of Classicality via Teleportation. With Simone Rijavec and Maria Violaris; joint presentation with Maria Violaris. *University of Oxford, Prof. Vlatko Vedral's Seminar*, Oxford, UK.
- 2023 Teleportation Revealed. *Université de Montréal, Quantum Information Seminar*, Montréal, Canada.
- 2022 Quantum Locality: Unification, Cost and Consequences. *Chapman University* (online), Los Angeles, CA, USA.
- 2022 Teleportation Revealed. *Centrum Wiskunde & Informatica Seminar*, Amsterdam, Netherlands. [Available on YouTube](#).
- 2022 Emergence, Sophistication and Epistemology. *Instituto Superior Técnico, Seminar of Computation and Logic*, Lisbon, Portugal.
- 2022 Some Other Ideas of Karl Popper. *Università della Svizzera italiana, Information and Physics Student Seminar*, Lugano, Switzerland.
- 2020 The Cost of Quantum Locality. *University of Oxford, Prof. Vlatko Vedral's Seminar*, Oxford, UK.
- 2019 An Algorithmic Approach to Emergence. *Università della Svizzera italiana, Prof. Stefan Wolf's Seminar*, Lugano, Switzerland.
- 2019 An Algorithmic Approach to Quantify Emergence. *IQOQI, Dr Marcus Huber's Seminar*, Vienna, Austria.
- 2018 An Algorithmic Approach to Quantify Emergence. *University of Ottawa*, Ottawa, Canada.
- 2017 Kolmogorov Amplification from Bell Correlation. *IQOQI, Prof. Časlav Brukner's Seminar*, Vienna, Austria.
- 2016 New Results on the Complexity Analysis of the PR Box. *Università della Svizzera italiana*, Lugano, Switzerland.
- 2016 Kolmogorov Complexity Analysis of the PR Box. *Università della Svizzera italiana*, Lugano, Switzerland.
- 2016 Kolmogorov Complexity of the Nonlocal Box. *Université de Montréal*, Montréal, Canada.



Contributed Presentations

- 2025 Explaining Bell Locally. *Conference of the Institut transdisciplinaire de recherche en informatique quantique (INTRIQ)*, Montréal, Canada.
- 2024 From Locality to Causality in the Heisenberg Picture. *Causalworlds 2024*, Perimeter Institute, Waterloo. [Available on PIRSA](#).
- 2023 Temperature as Joules per Bit. With Sophie Berthelette, Xavier Coiteux-Roy and Stefan Wolf; presented by Sophie Berthelette. *The 21st European Conference on Foundations of Physics*, Bristol, UK.
- 2023 On Defining Kolmogorov Complexity. *The Kolmogorov Workshop*, University of Geneva, Geneva, Switzerland.
- 2021 The Cost of Quantum Locality. *American Physical Society (APS) March Meeting* (online). [Abstract](#).
- 2019 Quantum Locality. *Student Conference of INTRIQ (CONFETI)*, Bromont, Canada.
- 2019 Sophistication and Logical Depth under Relativization. *Benasque Quantum Information*, Benasque, Spain.
- 2018 An Algorithmic Approach to Quantify Emergence. With Geoffroy Bergeron. *INTRIQ Conference*, Bromont, Canada.
- 2018 An Algorithmic Approach to Emergence. With Geoffroy Bergeron. *CONFETI*, Bromont, Canada.
- 2017 Kolmogorov Amplification from Bell Correlation. With Ämin Baumeler, Gilles Brassard and Stefan Wolf. *IEEE International Symposium on Information Theory (ISIT)*, Aachen, Germany.
- 2017 Kolmogorov Amplification from Bell Correlation. With Ämin Baumeler, Gilles Brassard and Stefan Wolf. *INTRIQ Conference*, Bromont, Canada.
- 2017 Non-locality Through Kolmogorov's Lens. *CONFETI*, Bromont, Canada.
- 2015 Causality in Quantum Field Theory. *CONFETI*, Bromont, Canada.



Poster Presentations

- 2024 Quantum Teleportation Using a Genuinely Classical Communication Channel Must Fail. With Simone Rijavec and Maria Violaris; poster presented by Maria Violaris. *The Bristol Quantum Information Technologies Workshop*, Bristol, UK.
- 2017 Kolmogorov Amplification from Bell Correlation. With Ämin Baumeler, Gilles Brassard and Stefan Wolf. *Solstice of Foundations*, Zurich, Switzerland.



Public Lectures and Outreach

- 2019 Why Is It So Beautiful? Département de physique, Université de Montréal, Montréal, Canada. Public talk organized in conjunction with my thesis defence.
- 2019 The Real Mystery of Quantum Physics. *Collège Jean-de-Brébeuf*, Montréal, Canada.
- 2018 Bell's Theorem and Quantum Computing. *Midiro, Université de Montréal*, Montréal, Canada.
- 2017 The War of Secrets. *Forum de la recherche du Regroupement des étudiants-chercheurs en sciences de l'Université de Sherbrooke (RECSUS)*, Sherbrooke, Canada.

- 2017 The Science of Skiing. *Skiposium of the Quebec Committee of the Canadian Ski Instructors' Alliance (CSIA)*, Terrebonne, Canada. [Available on YouTube](#).
- 2017 The Second Mystery of Quantum Physics. *Pint of Science Canada*, Montréal, Canada.
- 2016 Bell's Theorem. *Club Mathématique, Département de mathématiques et de statistique, Université de Montréal*, Montréal, Canada.
- 2016 The Physics of Mathematics. *Flash Bac, Département de physique, Université de Montréal*, Montréal, Canada.
- 2016 Bell's Theorem. *Flash Bac, Département de physique, Université de Montréal*, Montréal, Canada.
- 2015 Theoretical Computer Science: The Science of Programmers or the Foundation of Mathematics? *Club Mathématique, Département de mathématiques et de statistique, Université de Montréal*, Montréal, Canada.
- 2014 Variational Calculus and Physical Principles. *Conférence du DEC Plus, Collège André-Grasset*, Montréal, Canada.
- 2013 Variational Calculus and Physical Principles. *Club Mathématique, Département de mathématiques et de statistique, Université de Montréal*, Montréal, Canada.



Grants and Fellowships

- 2025–2027 Postdoctoral Fellowship, Mitacs Elevate, in collaboration with Bbox Digital.
- 2023 Hasler Foundation Small Project Grant, CHF 50,000 (PI: Stefan Wolf); principal author of the successful proposal.
- 2023 One-year extension awarded. Postdoctoral scholarship, Fonds de recherche du Québec – Nature et technologies (FRQNT).
- 2020–2022 Postdoctoral scholarship, FRQNT.
- 2019 Scholarship for research internship abroad, FRQNT.
- 2019 Michael-Smith supplement for internship abroad, Natural Sciences and Engineering Research Council of Canada (NSERC).
- 2017 Alexander-Graham-Bell scholarship for doctoral studies, NSERC.
- 2016 NSERC Postgraduate Scholarship–Doctoral (PGS D).
- 2016 Doctoral scholarship of the FRQNT.
- 2016 Hydro-Québec's doctoral scholarship.
- 2014 Scholarship for direct admission from the bachelor's program to the PhD, Université de Montréal.
- 2014 NSERC scholarship for graduate studies.
- 2014 FRQNT scholarship for graduate studies.
- 2013 Mobility grant for student exchange, Université de Montréal.
- 2012 Grant for summer research internship, NSERC.
- 2011 Grant for summer research internship, Centre de recherches mathématiques, Montréal.



Awards and Honours

- 2026 Invited participant, 13th Heidelberg Laureate Forum, Heidelberg, Germany, September 2026; invited by Turing laureate Gilles Brassard. [Forum website](#).
- 2025 Fellow, Conjecture Institute. <https://www.conjectureinstitute.org>
- 2018 Best Short Talk Award, CONFETI.
- 2017 Best Introductory Talk Award, CONFETI.
- 2015, 2016 Two-time recipient of the Best Flash-Bac Talk Award, recognizing graduate students who present their research to undergraduates.
- 2015 Pico Nobel, a student-selected award for the most highly regarded teaching assistant.
- 2014 Valedictorian at the bachelor's graduation ceremony.
- 2011, 2012 Member of Université de Montréal's team for the Putnam Mathematical Competition. The team ranked 37th of 572 teams in 2011 and 32nd of 578 teams in 2012. Individual scores: 11 in 2011 and 20 in 2012.
- 2003–2009 Recipient of distinctions in the Gauss, Pascal, Cayley, BiMathlon, AMQ, AIME, and AMC-12 mathematics competitions during high school and CEGEP.



Additional Experience and Leadership

- 2005–2021 **Ski instructor, technical director and course conductor**, Mont Sutton Ski School (Canada); Whistler Blackcomb Ski School (Canada); Escuela de Ski Portillo (Chile); Nozawa Onsen Ski School (Japan); Alpine Sports Andermatt (Switzerland); CSIA.
- 2011–2013 **Science competition coach**, Collège Regina Assumpta, Montréal.
- 2014–2018 Member of the high-performance team of the CSIA.
- 2005–2018 Recipient of several awards at Mont Sutton Ski School, including trainer of the year, the “Moniteur emblème” award, most requested instructor for private lessons, most improved instructor and rookie of the year.
 - 2010 Youngest person ever to earn Level 4 certification from the CSIA.
 - 2010 Level 2 certification from the Canadian Ski Coaches Federation (CSCF).
- 2015–2018 **Member of the Québec board**, CSIA.
Established a regional delegate program that reached more than 200 members.
- 2015–2016 **Volunteer at Action humanitaire et communautaire**, Université de Montréal.
Supported international exchange students at Université de Montréal.
- 2011–2016 **Volunteer speaker**, High schools in Canada and Switzerland.
Purpose: To stimulate the interest of high school students in mathematics and physics.
Commitment: Developed three educational presentations (Euler's identity, astrophysics and relativity), delivered more than 10 times to approximately 500 students.
- 2007–2011 **Active participant in the Terry Fox Run**, City of La Prairie, Canada.
Raised \$2,500 by completing annual runs of 21–32 km.



Languages

French Mother tongue

English Fluent

Italian Conversational proficiency

Spanish Conversational proficiency

German Basic proficiency