

# Curriculum vitae: David Gontier

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Responsable académique du département Ingénierie Mathématique et Informatique  
Chercheur au CERMICS  
École Nationale des Ponts et Chaussées

## Short Curriculum

- 2025-...** • Responsable académique IMI, Chercheur at CERMICS (ENPC).
- 2024** • **Habilitation** (HDR) at Ceremade (Université Paris–Dauphine):
  - title: *Periodic and half-periodic fermionic systems*
- 2021-2024** • Partial time (50%) at DMA (ENS Ulm).
- 2016-2025** • Maître de conférences at Ceremade (University Paris-Dauphine).
- 2015-2016** • **Post-doc** at ETH Zürich, under the supervision of Habib AMMARI.
- 2012-2015** • **PhD** at CERMICS (École des Ponts ParisTech):
  - title: *Contributions mathématiques aux calculs de structures électroniques*
  - under the supervision of Éric CANCÈS.
- 2008-2012** • Student at École Normale Supérieure de Paris:
  - **Master 2** in Mathematics (Master ANEDP, University Paris 6).
  - **Master 2** in Informatics (Master MPRI, University Paris 7).

## Fundings obtained

- 2023:** AAP-CNRS-Africa Visiting Fellowship (25.000€, with S. LAHBABI)
- 2022:** AAP-IRL (4000€, with H. VAN DEN BOSCH)
- 2019:** PICS (12.000€, with S. LAHBABI)
- 2018:** PEPS-INSMI (1.500€, with S. LAHBABI)
- 2017:** PEPS-INSMI (1.500€, with A. LEVITT)

## Responsibilities

- 2022-2024:** Member (elected) of the *Comité Environmental et Social* of University Paris-Dauphine.
- 2020-2024:** Member (elected) at the Scientific Council of University Paris-Dauphine.
- 2019-2023:** Member (nominated) at CNU (*Conseil National des Universités*), section 26.
- 2019-...:** Member of the committee *Responsabilité environnementale* of Ceremade (carbon footprint).

## Distinctions

- 2015** - *Prix de thèse* at University Paris-Est
- 2006** - *Concours générale* in mathematics (2<sup>nd</sup> accessit)
  - International Mathematical Olympiads, Ljubljana (mention)

## Publication List

- [1] C. Gómez Araya, D. Gontier, and H. Van Den Bosch. “Edge states for tight-binding operators with soft walls”. In: *arXiv preprint arXiv:2403.02462* (2024).
- [2] D. Gontier, A. E. K. Kouande, and É. Séré. “Exponential decay of the critical points in a discrete model of polyacetylene”. In: *Nonlinearity* 38.1 (2024), p. 015002.
- [3] É. Cancès, L. Garrigue, and D. Gontier. “Second-Order Homogenization of Periodic Schrödinger Operators with Highly Oscillating Potentials”. In: *SIAM Journal on Mathematical Analysis* 55.3 (2023), pp. 2288–2323.
- [4] É. Cancès, L. Garrigue, and D. Gontier. “Simple derivation of moiré-scale continuous models for twisted bilayer graphene”. In: *Phys. Rev. B* 107 (15 2023), p. 155403.
- [5] J. Dolbeault, D. Gontier, F. Pizzichillo, and H. Van Den Bosch. “Keller and Lieb–Thirring estimates of the eigenvalues in the gap of Dirac operators”. In: *Revista Matemática Iberoamericana* (2023). ISSN: 0213-2230.
- [6] R. L. Frank, D. Gontier, and M. Lewin. “Optimizers for the finite-rank Lieb-Thirring inequality”. In: *arXiv:2109.05984 (accepted in American Journal of Mathematics)* (2023).
- [7] D. Gontier. “Edge states for second order elliptic operators in a channel”. In: *Journal of Spectral Theory* 12.3 (2023), pp. 1155–1202.
- [8] D. Gontier, A. E. K. Kouande, and É. Séré. “Phase Transition in the Peierls Model for Polyacetylene”. In: *Annales Henri Poincaré* (2023).
- [9] D. Gontier, S. Lahbabi, and A. Maichine. “Density functional theory for two-dimensional homogeneous materials with magnetic fields”. In: *Journal of Functional Analysis* 285.9 (2023), p. 110100. ISSN: 0022-1236.
- [10] D. Gontier, D. Monaco, and S. Perrin-Roussel. “Symmetric Fermi projections and Kitaev’s table: Topological phases of matter in low dimensions”. In: *Journal of Mathematical Physics* 63.4 (2022), p. 041902.
- [11] R. L. Frank, D. Gontier, and M. Lewin. “The Nonlinear Schrödinger Equation for Orthonormal Functions II: Application to Lieb–Thirring Inequalities”. In: *Communications in Mathematical Physics* 384.3 (2021), pp. 1783–1828.
- [13] D. Gontier. “Spectral properties of periodic systems cut at an angle”. In: *Comptes Rendus. Mathématique* 359.8 (2021), pp. 949–958.
- [14] D. Gontier, S. Lahbabi, and A. Maichine. “Density Functional Theory for Two-Dimensional Homogeneous Materials”. In: *Communications in Mathematical Physics* 388.3 (2021), pp. 1475–1505.
- [15] D. Gontier, M. Lewin, and F. Q. Nazar. “The nonlinear Schrödinger Equation for Orthonormal Functions: Existence of Ground States”. In: *Archive for Rational Mechanics and Analysis* 240.3 (2021), pp. 1203–1254.
- [16] A. Bakhta, V. Ehrlacher, and D. Gontier. “Numerical reconstruction of the first band(s) in an inverse Hill’s problem”. In: *ESAIM: Control, Optimisation and Calculus of Variations* 26 (2020), p. 59.
- [17] É. Cancès, V. Ehrlacher, D. Gontier, A. Levitt, and D. Lombardi. “Numerical quadrature in the Brillouin zone for periodic Schrödinger operators”. In: *Numerische Mathematik* 144.3 (2020), pp. 479–526.
- [18] D. Gontier. “Edge states in ordinary differential equations for dislocations”. In: *Journal of Mathematical Physics* 61.4 (2020), p. 043507.
- [19] H. D. Cornean, D. Gontier, A. Levitt, and D. Monaco. “Localised Wannier Functions in Metallic Systems”. In: *Annales Henri Poincaré* 20.4 (2019), pp. 1367–1391.
- [20] D. Gontier, A. Levitt, and S. Siraj-dine. “Numerical construction of Wannier functions through homotopy”. In: *Journal of Mathematical Physics* 60.3 (2019), p. 031901.
- [21] D. Gontier, C. Hainzl, and M. Lewin. “Lower bound on the Hartree-Fock energy of the electron gas”. In: *Physical Review A* 99.5 (2019).

- [22] D. Gontier and S. Lahbabi. “The reduced Hartree-Fock model with self-generated magnetic fields”. In: *Journal of Mathematical Physics* 60.8 (2019), p. 081902.
- [23] D. Gontier and M. Lewin. “Spin Symmetry Breaking in the Translation-Invariant Hartree-Fock Electron Gas”. In: *SIAM Journal on Mathematical Analysis* 51.4 (2019), pp. 3388–3423.
- [24] H. Ammari, B. Fitzpatrick, D. Gontier, H. Lee, and H. Zhang. “Minnaert resonances for acoustic waves in bubbly media”. In: *Annales de l'Institut Henri Poincaré C, Analyse non linéaire* 35.7 (2018), pp. 1975–1998.
- [25] H. Ammari, B. Fitzpatrick, D. Gontier, H. Lee, and H. Zhang. “A Mathematical and Numerical Framework for Bubble Meta-Screens”. In: *SIAM Journal on Applied Mathematics* 77.5 (2017), pp. 1827–1850.
- [26] H. Ammari, B. Fitzpatrick, D. Gontier, H. Lee, and H. Zhang. “Sub-wavelength focusing of acoustic waves in bubbly media”. In: *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences* 473.2208 (2017), p. 20170469.
- [27] É. Cancés, D. Gontier, and G. Stoltz. “A mathematical analysis of the GW0 method for computing electronic excited energies of molecules”. In: *Reviews in Mathematical Physics* 28.04 (2016), p. 1650008.
- [28] D. Gontier. “Pure-state N-representability in current-spin-density functional theory”. In: *Communications in Mathematical Sciences* 14.4 (2016), pp. 987–1003.
- [29] D. Gontier and S. Lahbabi. “Convergence rates of supercell calculations in the reduced Hartree-Fock model”. In: *ESAIM: Mathematical Modelling and Numerical Analysis* 50.5 (2016), pp. 1403–1424.
- [30] D. Gontier and S. Lahbabi. “Supercell Calculations in the Reduced Hartree-Fock Model for Crystals with Local Defects”. In: *Applied Mathematics Research eXpress* (2016).
- [31] D. Gontier. “Existence of minimizers for Kohn-Sham within the local spin density approximation”. In: *Nonlinearity* 28.1 (2014), pp. 57–76.
- [32] D. Gontier and M. Vetterli. “Sampling based on timing: Time encoding machines on shift-invariant subspaces”. In: *Applied and Computational Harmonic Analysis* 36.1 (2014), pp. 63–78.
- [33] D. Gontier. “N-Representability in Noncollinear Spin-Polarized Density-Functional Theory”. In: *Physical Review Letters* 111.15 (2013).

## Oral presentations

(Most slides are available here: <https://www.ceremade.dauphine.fr/~gontier/presentations.html>)

## Conferences

- *Phase transition in Peierls/SSH model*  
[Model Systems in Quantum Mechanics](#). (Toulouse, January 2024).
- *Keller estimates for Dirac operators*  
[Many-Body Quantum Systems](#). (Oberwolfach, September 2023).
- *Spectral properties of materials cut in half*  
[Solid Math 2022](#). (Trieste, September 2022).
- *Spectral properties of materials cut in half*  
[Mathematical results of many-body quantum systems](#). (Herrsching, June 2022).
- *Density Functional Theory for two-dimensional materials*  
[GDR NBODY](#). (Toulouse, January 2022).
- *Crystallization in Lieb-Thirring inequalities*  
[ICMP 2021](#). (Genève, August 2021).
- *The reduced Hartree-Fock model with self-generated magnetic fields*  
[Density Functionals for Many-Particle Systems](#). (Singapour, September 2019).
- *Symmetry breaking in the reduced Hartree-Fock-Dirac model*  
[Many-Body quantum systems](#). (Oberwolfach, September 2019).
- *Symmetry breaking in the Hartree-Fock jellium*

- [Mean-field and other effective models in mathematical physics](#). (Fondation les Treilles, May 2019).
- *Méthode de super-cellules pour les cristaux*  
[SMAI 2019](#). (Guidel plage, May 2019).
- *Symmetry breaking in the Hartree-Fock jellium*  
[Optimal transport methods in Density Functional Theory](#). (Banff, January 2019).
- *Spin symmetry breaking in the Hartree-Fock electron gas*  
[Franco-German Workshop on mathematical aspects in computational chemistry](#). (Aachen, September 2018).
- *Spin symmetry breaking in the Hartree-Fock electron gas*  
[Solid Math](#). (Montréal, August 2018).
- *Localised Wannier functions in metallic systems*  
[ICMP](#). (Montréal, July 2018).
- *Localised Wannier functions in metallic systems*  
[Analytical & Numerical Methods in Quantum Transport](#). (Aalborg, May 2018).
- *Numerical methods for Brillouin zone integration*  
[Mathematical Methods in Quantum Chemistry](#). (Oberwolfach, March 2018).
- *Supercell method for the computation of energies of crystals*  
[2016-17 Warwick EPSRC Symposium: DFT and Beyond: Analysis and Computation](#). (Warwick, July 2017).
- *A mathematical study of the GW0 method for computing electronic excited states of molecules*  
[GDR DynQua](#). (Grenoble, February 2015).
- *A mathematical study of the GW0 method for computing electronic excited states of molecules*  
[Mathematical Methods in Quantum Molecular Dynamics](#). (Oberwolfach, June 2015).
- *Pure-state N-representability in current-spin-density-functional theory*  
[Fundamental Aspects of DFT](#). (Oslo, January 2015).
- *A mathematical study of the GW method: the irreducible polarizability*  
[Solid Math](#). (Trieste, June 2014).
- *A mathematical study of the GW method*  
[Theoretical and Numerical Aspects of Quantum Transport](#). (Aalborg, April 2014).
- *Existence of minimizers for Kohn-Sham within the Local Spin Density Approximation*  
[Mathematical and Numerical Analysis of Electronic Structure Models](#). (Berlin, April 2014).
- *N-representability in SDFT*  
[GDR-CoDFT](#). (Guidel, May 2013).

## Seminars

- *Le problème de Keller pour l'opérateur de Dirac*  
Séminaire ANEDP Orsay (Université Paris Saclay, November 2023).
- *Le travail de Maryna Viazovska (Fields 2022)*  
Journée CPGE-ENS. (ENS Ulm, May 2023).
- *Density Functional Theory for two-dimensional homogeneous materials*  
Séminaire EMC2. (Sorbonne University, November 2022).
- *Spectral properties of materials cut in half*  
MAS-MP Seminar. ((online), May 2022).
- *Spectral properties of materials cut in half*  
Séminaire du groupe analyse du LMR. (Reims, May 2022).
- *Edge states in half-periodic systems*  
SAM Science Slam (alumni reunion). (Zurich, November 2021).
- *Density Functional Theory for two-dimensional materials*  
Oberseminar 'Calculus of Variations and Applications'. (Munich (online), November 2021).
- *La bataille d'Actium, Mythe et Maths*  
Focus recherche, rentrée ENS 2021. (ENS Ulm, September 2021).
- *N-solitons and Lieb-Thirring inequality*  
Meeting ERC MDFT (M. Lewin). (Webinar (Ceremade, Paris-Dauphine), June 2021).
- *Edge states for second order elliptic operators*  
Meeting ERC MDFT (M. Lewin). (Webinar (Ceremade, Paris-Dauphine), March 2021).
- *Edge states in semi materials*

- Séminaire de Mathématiques. (Webinar (UPM6, Ben Guerir, Maroc), January 2021).
- *Cristallisation in Lieb-Thirring inequality*  
Séminaire Problème spectraux en Physique Mathématique. (Webinar (IHP, Paris), October 2020).
- *Edge States in ODE for dislocations*  
Séminaire POEMS. (INRIA Saclay, Avril 2020).
- *Edge States in ODE for dislocations*  
Séminaire EDP et Physique Mathématiques. (LAGA, University Paris XIII, Avril 2020).
- *The Hartree-Fock electron gas*  
PDE and Mathematical Physics. (University of Zurich, November 2019).
- *The Hartree-Fock electron gas*  
Séminaire ANEDP Orsay. (Université Paris-Saclay, June 2019).
- *The Hartree-Fock electron gas*  
Oberseminar Analysis. (Munich, February 2019).
- *Bosons, fermions et processus ponctuel*  
Escapade (Ceremade). (Paris-Dauphine, December 2018).
- *Minnaert resonance in bubbly media*  
Matinée du Ceremade. (Paris-Dauphine, January 2018).
- *Minnaert resonance in bubbly media*  
Séminaire Pierre-Louis Lions. (Collège de France, June 2017).
- *Supercell method for the computation of energies of crystals*  
Young Researchers Workshop on Mathematical Models in Quantum Chemistry. (Paris 6, January 2017).
- *Méthode de supercellule pour la simulation de cristaux sans/avec défauts*  
Séminaire CMAP. (École Polytechnique, April 2016).
- *Supercell calculations for the simulation of crystals with/without defects*  
Séminaire POEMS. (INRIA Saclay, February 2016).
- *The supercell model for the simulation of crystals, with and without defects*  
Séminaire équations non linéaire. (Paris 13, November 2015).
- *An introduction to quantum chemistry: the Hartree-Fock model*  
PhD seminar of Marne-la-Vallée. (ESIEE, June 2014).
- *Complexity of a Sudoku*  
PhD seminar of CERMICS/CEREA/IMAGINE. (CERMICS, March 2014).
- *Representability in non-collinear spin-polarized density functional theory*  
Mathematical and Numerical Analysis of Electronic Structure Models. (IHP, July 2013).
- *Magnetic Schrödinger operators and magnetic density functional theory*  
PhD seminar of CERMICS. (CERMICS, April 2013).

## Organisation of conferences / seminars

- 2022-2024: co-organization (with Silvain RIDEAU) of the *Séminaire Des Mathématiques* of DMA (ENS).
- 2021: Mini-symposium SIAM: *Electronic Structure Methods: Quantum Magnetism and Numerical Approaches Beyond Density-Functional Theory* (with Carlos Garcia. CERVERA).
- 2020: [Solid Math 2021](#) (with É. CANCÈS, H. CORNEAN and G. PANATI).
- 2019: Mini-symposium SMAI: *Étude numérique des opérateurs périodiques* (with A. LEVITT).

## Teaching

### University

Name of the course	Year	Location	Teacher
Modèles non linéaires en mécanique quantique (M1)	2023-2024	ENS	DG
	2022-2023		DG
	2021-2022		DG
Reading group (optimal transport) Reading group (spectral theory) Reading group (harmonic analysis)	2023-2024	ENS	DG
	2022-2023		DG
	2021-2022		DG
Calcul Différentiel et optimisation (L2)	2023-2024	Dauphine University	DG
Méthodes numériques et optimisation (L3)	2020-2021	Dauphine University	DG
	2019-2020		DG
	2018-2019		DG
	2017-2018		DG
	2016-2017		A. FROUVELLE
Review of PDEs (M2)	2023-2024	Dauphine University	DG
	2022-2023		DG
	2021-2022		DG
	2020-2021		DG
Calcul différentiel (L3)	2018-2019	Dauphine University	E. BOUIN
	2018-2019		E. BOUIN
	2017-2018		J. FÉJOZ
	2016-2017		J. FÉJOZ
Maths fondamentales, Analyse (L2)	2023-2024	PSL University	DG
	2022-2023		DG
	2021-2022		DG
	2020-2021		DG
	2019-2020		DG
Calcul différentiel (PSL, L2)	2018-2019	PSL University	É. SÉRÉ
	2017-2018		É. SÉRÉ
	2016-2017		É. SÉRÉ
Inverse Problems	2015-2016	ETH Zürich	R. ALAIFARI
Numerical Method for CSE	2015-2016	ETH Zürich	R. HIPTMAIR
Analysis 1	2014-2015	Ponts ParisTech	É. CANCÈS
Fonctions à plusieurs variables	2013-2014	ESIEE	DG
	2012-2013		DG

### Other

- Interventions in *Paroles de chercheurs, paroles de chercheuses* (vulgarization for high school students), in 2021 and 2022.
- Summer School (with É. CANCÈS and G. DUSSON, Roscoff, 2018).
- 12 hours mini-course (with A. LEVITT) on numerical methods for condensed matter (Aalborg, Denmark, 2016).

## Students

**Postdoc:** Faizan NAZAR (with M. LEWIN, 2017)

**PhD:** Thaddeus ROUSSIGNÉ (with É. SÉRÉ, 2023-...)  
Solal PERRIN-ROUSSEL (with É. CANCÈS, 2022-...)  
Camilo GÓMEZ-ARAYA (with J. DOLBEAULT, 2021-...)  
Adéchola KOUANDE (with É. SÉRÉ, 2020-...)

**Master 2:** Thaddeus ROUSSIGNÉ (2023), Camilo GÓMEZ-ARAYA (2021), Adéchola KOUANDE (2020).

**Master 1:** Solal PERRIN-ROUSSEL (with D. Monaco, 2020), Majdouline Borji (with M. LEWIN, 2018)

**Licence:** Alexander FLAMANT (with Lino BENEDETTO, 2023), Lila ATIFI & Aurélie CHOPARD-LALLIER & Soline DU CREST (2023), Gaspard DOUSSON LYS & Elliott GALLOIS & Giacomo SPRIANO (with Phong NGUYEN, 2023), Siméon GHEORGHIN (2023), Adrien MATHIEU & Martin BEAUFILS (2022), Lucas PERRIN (2020), Léonie PAPON (2019), Oscar COSSERAT (2017).