

# Mathieu LEWIN

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Né le 14 Novembre 1977 à Senlis (France)

## Positions

Oct. 2014 – Directeur de Recherche CNRS  
CEREMADE, Université Paris-Dauphine

Sept. 2017 – Professeur chargé de cours  
École Polytechnique, Palaiseau

Oct. 2005 – Sept. 2014 Chargé de Recherche CNRS  
Laboratoire de Mathématiques, Université de Cergy-Pontoise

Mar. 2005 – Août 2005 Post-doc INRIA  
CERMICS, École Nationale des Ponts et Chaussées, avec Éric Cancès

Août 2004 – Fév. 2005 EU Post-doc  
University of Copenhagen (Danemark), avec Jan Philip Solovej

## Diplômes et formation

Juin 2009 Habilitation à diriger des recherches, Université de Cergy-Pontoise

Juin 2004 Thèse de doctorat avec Éric Séré, Université Paris Dauphine

Sept. 1998 – Août 2002 Élève normalien à l'ENS Cachan

## Distinctions

2022 Conférencier invité au congrès international de mathématiques (ICM 2022)

2017 – 2023 Consolidator Grant du European Research Council (ERC)

2015 Plenary speaker at the International Congress of Mathematical Physics

2012 EMS Prize

2010 – 2015 Starting Grant du European Research Council (ERC)

## Activités éditoriales

2023 – Éditeur pour *Journal of Spectral Theory*

2022 – Éditeur en chef (avec Anne-Laure Dalibard) pour les *Annales de l'Institut Henri Poincaré C – Analyse Non Linéaire*

2019 – Éditeur pour *Probability and Mathematical Physics*

2014 – Éditeur pour *Letters in Mathematical Physics*

2013 – Éditeur pour *Mathematical Models and Methods in Applied Sciences (M3AS)*

## Responsabilités administratives

2023 –	Directeur du CEREMADE (UMR CNRS 7534)
2020 –	Membre du comité scientifique du labex CEMPI de Lille
2019 – 2022	Membre du comité éthique de la recherche de l’université Paris-Dauphine
2015 – 2021	Membre élu du conseil d’administration de la SMAI
2015 – 2020	Membre élu du conseil exécutif de l’association internationale de physique mathématique (IAMP)
Oct. 2014 – Dec. 2017	Chargé de mission CNRS/INSMI : membre du comité de pilotage de la Mission pour l’Interdisciplinarité du CNRS (MI)
2010 – 2014	Membre élu du conseil d’administration de l’institut Henri Poincaré
2010 – 2014	Correspondant local à Cergy de la SMF et la SMAI
2008 – 2017	Correspondant local du GDR “Dynamique Quantique” ( <a href="#">webpage</a> )

## Comités & autres

2018	Président du comité pour le IAMP Early Career Award
2015 & 2016	Membre du comité maths-info de l’ANR
2015 & 2016	Président du comité de sélection pour les postes MCF d’analyse à Dauphine

## Projets & réseaux

2017 – 2023	PI of the ERC Consolidator Grant <i>Mathematics of Density Functional Theory</i> , H2020 no. 725528.
2018 – 2022	Responsable local du projet ANR <i>molQED</i> (molecular Quantum Electrodynamics) en chimie
2010 – 2015	PI of the ERC Starting Grant <i>Mathematics and Numerics of Infinite Quantum Systems</i> , FP7/2007–2013 no. 258023.
2010 – 2014	Coordinateur du projet ANR <i>NoNAP</i> (Nonlinear Methods in Atomic and Nuclear Physics)
2010 – 2011	Grant PHC-Alliance obtenu avec Lyonell Boulton (Heriot Watt University, Écosse)
2005 – 2009	Membre du projet ANR <i>ACCQUAREL</i> (Approches Computationnelles en Chimie QUAntique RELativiste)

## Étudiants

### Post-Docs

Michal Jex, Sept. 2020 – Août 2022
Peter Madsen, Oct. 2019 – Fév. 2023
Fabio Pizzichillo, Oct. 2018 – Oct. 2021
Thomas Ourmières-Bonafos, Sept. 2018 – Août 2019
Luca Nenna, Sept. 2017 – Août 2018
Faizan Nazar, Janv. 2017 – Août 2019
Jonas Lampart, Janv. 2014 – Sept. 2016
Simona Rota-Nodari, Oct. 2012 – Sept. 2013
Phan Thành Nam, Oct. 2011 – Sept. 2013
Nicolas Rougerie, Déc. 2010 – Sept. 2011
Marco Ghimenti, 2007
Guillaume Legendre (avec É. Séré), Nov. 2006 – Août 2007

## Doctorant-e-s

Martin Malvy, avec Laure Dumaz, Sept. 2022–

Rodrigue Lelotte, Sept. 2020 –Sept. 2023

Jean Cazalis, Sept. 2018 – Août 2022

Louis Garrigue, Sept. 2017 – Sept. 2020

Arnaud Triay-Alcouffe, Sept. 2015 – Juin 2019

Raphaël Ducatez, Sept. 2015 – Août 2018

Julien Ricaud, Oct. 2012 – Juin 2017

Salma Lahbabi, avec Éric Cancès, Oct. 2010 – Juil. 2013

Julien Sabin, Sept. 2010 – Déc. 2013

Séverine Paul, Sept. 2008 – Oct. 2012

Codirecteur d'Amélie Deleurence (thèse avec Éric Cancès), Sept. 2005 – Déc. 2008

## Master & autres

Pascal Capetillo & Jonathan Hornewall, 2022 (Polytechnique)

Yvann Gaudillot Estrada, 2021 (ENS)

Florent Fougères, 2021 (Polytechnique)

Rodrigue Lelotte, 2019 & 2020 (Polytechnique)

Louis Garrigue, 2017 (ENS)

Raphaël Ducatez, 2015 (ENS)

Arnaud Triay, 2013, 2014 & 2015 (ENS Lyon)

Thomas Dumas, 2013 (master Cergy)

Julien Ricaud, 2012 (master Paris 6)

Julien Sabin, 2008 & 2009 (ENS Lyon & master Dauphine)

## Enseignements récents

### Cours

2016 – Cours et petites Classes, École Polytechnique

2007 – *Théorie spectrale et méthodes variationnelles* (avec Éric Cancès), M2 Analyse-EDP, Univ. Paris Pierre & Marie Curie, **web**

2017 *Analyse Fonctionnelle et mécanique quantique*, M2 Mathématiques Fondamentales, Univ. Pierre & Marie Curie, **web**

2014 & 2015 Leçon de Mathématiques *Inégalités fonctionnelles et mécanique quantique*, École Normale Supérieure

2006 – 2016 Cours / TD niveau M1 *Mathématiques des modèles multi-échelles* (avec Frédéric Legoll), École des Ponts - Paris Tech, **web**

## Cours pour (post-)doctorant-e-s

- Août 2023 *Statistical mechanics of Coulomb and Riesz gases* (4h), VIASM-IAMP Summer-school in Mathematical Physics, Quy Nhon, Vietnam
- Mars 2023 *Optimal transport in quantum chemistry and statistical mechanics* (2h), *Optimal Transport Theory and Applications to Physics*, Les Houches, France
- Nov. 2022 *Derivation of Gibbs measures from quantum mechanics* (4h), *Journées Louis Antoine*, Rennes, France
- Oct. 2022 Online course *Coulomb and Riesz gases: a review of what's known and unknown* (3h), Academy of Mathematics and System Sciences, Chinese Academy of Sciences, China. Peut être visualisé sur [youtube](#)
- Août 2022 *Coulomb and Riesz gases: the known and the unknown* (4h30), within the Conference *The Statistical Physics of Continuum Particle Systems with Strong Interactions*, Singapore
- Mai 2022 *The mathematical description of solids* (9h), Mini-school on mathematics for theoretical chemistry and physics, GDR *NBODY*, Paris, France
- Fév. 2022 *Lieb-Thirring inequalities: old and new* (3h), Conference of the GDR *Quantum Dynamics*, Toulouse, France
- Oct. 2021 *Large-scale limits for quantum gases* (4h), Conference on *Large-scale limits of interacting particle systems*, IHÉS, Bures sur Yvette, France. Peut être visualisé sur [youtube](#)
- Avril 2021 Mini-cours *Riesz and Coulomb gases: what's known and unknown* (2h), Séminaire en ligne du GDR MEGA. Peut être visualisé sur [youtube](#)
- Mars 2019 *Nonlinear Gibbs measures and their derivation from quantum mechanics* (6h), Mittag-Leffler Institute, Stockholm, Sweden
- Juil. 2017 *An introduction to critical point theory, with applications to quantum mechanics* (6h), Summerschool on *Current topics in Mathematical Physics*, Univ. Zürich, Suisse
- 2016 Cours de l'école doctorale, Université Paris-Dauphine
- Juin 2015 Cours de l'IHÉS sur les *Mesures de Gibbs non linéaires et leur dérivation à partir de la mécanique quantique* (8h), visible sur [youtube](#)
- Fév. 2015 *Open quantum systems and effective equations* (6h), École d'hiver, Research Training Group 1838 on *Spectral Theory and Dynamics of Quantum Systems* (Univ. Stuttgart & Tübingen), Freudenstadt, Allemagne
- Juil. 2013 *Mathematical foundations of quantum mechanics* (4h), École d'été "Mathématiques – Chimie – Calcul Haute Performance", Institut du Calcul et de la Simulation (Univ. P. & M. Curie), Roscoff, France
- Janv. 2012 *Nonlinear equations with fractional powers of the Laplacian and applications to quantum mechanics* (8h avec Enno Lenzmann), Università di Pisa, Italie
- Août 2011 *Geometric methods for nonlinear many-body quantum systems* (4h), Summerschool on *Current topics in Mathematical Physics*, Erwin Schrödinger Institute, Vienne, Autriche

## Organisation d'événements scientifiques

### Programmes longs

- 15 Avril – 13 Juil. 2013 (avec Maria J. Esteban) Trimestre thématique *Variational and Spectral Methods in Quantum Mechanics*, Institut Henri Poincaré, [web](#)
- 2008 Coordinateur du semestre thématique *Systèmes Quantiques, Systèmes Complexes*, Université de Cergy-Pontoise

## Conférences

- Déc. 2022 (avec S. Serfaty), conference on *Coulomb gases and universality*, Sorbonne Université, Paris, France
- 12 – 16 Août 2019 (avec J. Yngvason), session on *many-body systems*, Conference QMATH 14, Århus, Denmark
- 20 – 25 Mai 2019 Workshop on *Mean-field and other effective models in mathematical physics*, Fondation Les Treilles, France
- 28 Janv. – 1 Fév. 2019 (avec P. Gori Giorgi & B. Pass), Conference on *Optimal Transport Methods in Density Functional Theory*, Banff International Research Station, Canada
- 10 Sept. – 14 Sept. 2018 (avec R. L. Frank & B. Schlein), Conference on *Many-body Quantum Mechanics*, CRM Montréal, Canada
- 30 Juin – 4 Juil. 2014 (avec R. L. Frank), Conference *Effective Equations in Mathematical Physics*, Mittag Leffler Institute, Stockholm, Sweden
- 14 – 18 Avril 2014 (avec P. D’Ancona, M.J. Esteban, L. Fanelli, L. Vega & N. Visciglia), Conference *Analysis of Relativistic and Non-Relativistic models in Quantum Mechanics*, La Sapienza, Roma, Italy
- 6 – 10 Août 2012 (avec M. Griesemer) Session *Quantum many-body theory and condensed matter physics*, International Congress on Mathematical Physics, Ålborg, Denmark
- 21 – 25 Juin 2010 (avec É. Séré) Conference *Mathematical Aspects of Quantum Electrodynamics*, Institut Henri Poincaré, Paris, France
- 28 Mai 2009 Session *Applications to Quantum Chemistry*, Conference SCICADE 09, Beijing, China
- 21 – 25 Avril 2008 Conference *Quantum Statistical Physics and Information Theory*, Université de Cergy-Pontoise
- 31 Janv. – 1 Fév. 2008 (avec F. Germinet & L. Bruneau) Conference *Spectral Problems in Quantum Mechanics*, Université de Cergy-Pontoise
- Juil. 2007 (avec G. Turinici) Session *Computational issues in Relativistic Quantum Chemistry*, ICIAM, Zurich, Switzerland
- 3 – 6 Sept. 2006 (avec J.M. Barbaroux, F. Dunlop, F. Germinet, P. Hislop & F. Klopp) Conference *Transport and Spectral Problems in Quantum Mechanics* in honor of Jean-Michel Combes, Université de Cergy-Pontoise

## Écoles

- 3 Août – 7 Août 2015 (avec C. Hainzl, R. Seiringer, E. Stockmeyer, J. Tan & R. Tiedra), Summerschool *Current topics in Mathematical Physics*, Federico Santa María Technical University, Viña del Mar, Chile
- 2 – 7 Sept. 2013 (avec M.J. Esteban & R. Seiringer), Summerschool *Current topics in Mathematical Physics*, CIRM Marseille, France

## Séminaires

- 2020 – Membre du comité scientifique du *One World IAMP Mathematical Physics online Seminar*
- 2014 – Co-organisateur du séminaire mensuel “Problèmes spectraux” du GDR Dynamique Quantique, Institut Henri Poincaré
- 2017 – 2020 Co-organisateur du groupe de travail “ESCAPADE” en Analyse et Probabilités du CEREMADE, avec Laure Dumaz
- 2005 – 2014 Co-organisateur du groupe de travail de physique mathématique, Université de Cergy-Pontoise

## Activités de vulgarisation

- 2022 Interview par l'INSMI à l'occasion de l'ICM 2022, [website](#)
- 2021 Interview filmée pour le site "Parlons Maths", [youtube](#)
- 2019 Interview filmée par la FSMP à l'ICIAM 2019, [youtube](#)
- 2019 Interview à propos de la conjecture de cristallisation dans le dossier "Les maths expliquent le monde" de *Sciences et Avenir*, numéro 874
- 2017 M. Lewin, Bretzels, bagels, donuts et... topologie, CNRS Le Journal, [website](#)
- 2015 Portrait "Mathieu Lewin : Fidèle à une fantastique équation" publié dans le dossier "La jeune garde de la science" par le magazine *La Recherche* à l'occasion du numéro 500, [website](#)
- 2014 M. Lewin, Des cristaux et des maths, CNRS Le Journal, [website](#)
- 2014 Membre de l'équipe communication au CNRS pour l'année de la cristallographie

## Autres activités

- 2016–17 Interventions sur les projets ERC en mathématiques à l'Académie des Sciences Polonaises (2016), pour la formation des cadres supérieurs du CNRS (2017), et lors de la célébration des 10 ans de l'ERC au siège du CNRS avec les pays de l'EU13, [webpage](#)

# PUBLICATIONS

## Livres

- [1] M. Lewin. *Théorie spectrale et mécanique quantique*. Mathématiques et Applications (SMAI). Springer International Publishing, 2022.
- [2] R. L. Frank, A. Laptev, M. Lewin, and R. Seiringer, editors. *The Physics and Mathematics of Elliott Lieb: The 90th Anniversary Volume (2 books)*. EMS Press, 2022.

## Preprints

- [1] M. Jex, M. Lewin, and P. Madsen. Classical Density Functional Theory: The Local Density Approximation. *ArXiv e-prints*, 2023. [arXiv:2310.18028](#).
- [2] M. Lewin and P. T. Nam. Positive-density ground states of the Gross-Pitaevskii equation. *ArXiv e-prints*, 2023. [arXiv:2310.03495](#).
- [3] S. Di Marino, M. Lewin, and L. Nenna. Grand-canonical optimal transport. *ArXiv e-prints*, 2022. [arXiv:2201.06859](#).
- [4] I. Anapolitanos, M. Lewin, and M. Roth. Differentiability of the van der Waals interaction between two atoms. *ArXiv e-prints*, 2019. [arXiv:1902.06683](#).

## Articles acceptés ou publiés

- [1] M. Jex, M. Lewin, and P. Madsen. Classical Density Functional Theory: Representability and Universal Bounds. *J. Stat. Phys.*, 190: 23, mar 2023. [arXiv:2210.07785](#), DOI.
- [2] R. L. Frank, D. Gontier, and M. Lewin. Optimizers for the finite-rank Lieb-Thirring inequality. *Amer. J. Math.*, in press, 2023. [arXiv:2109.05984](#).
- [3] M. Lewin, E. H. Lieb, and R. Seiringer. Improved Lieb-Oxford bound on the indirect and exchange energies. *Lett. Math. Phys.*, 112: Art. 92, 2022. Themed collection “Mathematical Physics and Numerical Simulation of Many-Particle Systems”; V. Bach and L. Delle Site (eds.). [arXiv:2203.12473](#), DOI.
- [4] M. Lewin. Coulomb and Riesz gases: The known and the unknown. *J. Math. Phys.*, 63: 061101, 2022. Special collection in honor of Freeman Dyson. [arXiv:2202.09240](#), DOI.
- [5] J. A. Carrillo, M. G. Delgadino, R. L. Frank, and M. Lewin. Fast diffusion leads to partial mass concentration in Keller-Segel type stationary solutions. *Math. Models Methods Appl. Sci.*, 32(4): 831–850, 2022. [arXiv:2012.08586](#), DOI.
- [6] A. Teale, T. Helgaker, A. Savin, M. Lewin, and 66 other authors. DFT Exchange: Sharing Perspectives on the Workhorse of Quantum Chemistry and Materials Science. *Phys. Chem. Chem. Phys.*, 2022. Advance article. Preprint available on ChemRxiv:2022-13j2v. DOI.
- [7] M. J. Esteban, M. Lewin, and É. Séré. Dirac-Coulomb operators with general charge distribution. II. The lowest eigenvalue. *Proc. London Math. Soc.*, 123(4): 345–383, 2021. [arXiv:2003.04051](#), DOI.
- [8] M. J. Esteban, M. Lewin, and É. Séré. Dirac-Coulomb operators with general charge distribution. I. Distinguished extension and min-max formulas. *Ann. Henri Lebesgue*, 4: 1421–1456, 2021. [arXiv:2003.04004](#), DOI.
- [9] R. L. Frank, D. Gontier, and M. Lewin. The nonlinear Schrödinger equation for orthonormal functions II. Application to Lieb-Thirring inequalities. *Comm. Math. Phys.*, 384: 1783–1828, 2021. [arXiv:2002.04964](#), DOI.
- [10] D. Gontier, M. Lewin, and F. Q. Nazar. The nonlinear Schrödinger equation for orthonormal functions I. Existence of ground states. *Arch. Rat. Mech. Anal.*, 240: 1203–1254, 2021. [arXiv:2002.04963](#), DOI.
- [11] M. Lewin, P. T. Nam, and N. Rougerie. Classical field theory limit of many-body quantum Gibbs states in 2D and 3D. *Invent. Math.*, 224(2): 315–444, 2021. [arXiv:1810.08370](#), DOI.
- [12] M. Lewin and S. Rota Nodari. The double-power nonlinear Schrödinger equation and its generalizations: uniqueness, non-degeneracy and applications. *Calc. Var. Partial Differ. Equ.*, 59: 197, 2020. [arXiv:2006.02809](#), DOI.

- [13] S. Fournais, M. Lewin, and A. Triay. The Scott correction in Dirac-Fock theory. *Comm. Math. Phys.*, 378: 569–600, 2020. [arXiv:1911.09482](#), DOI.
- [14] M. Lewin and J. Sabin. The Hartree and Vlasov equations at positive density. *Comm. Partial Differential Equations*, 45(12): 1702–1754, 2020. [arXiv:1910.09392](#), DOI.
- [15] M. Lewin, E. H. Lieb, and R. Seiringer. The Local Density Approximation in Density Functional Theory. *Pure Appl. Anal.*, 2(1): 35–73, 2020. [arXiv:1903.04046](#), DOI.
- [16] I. Anapolitanos and M. Lewin. Compactness of molecular reaction paths in quantum mechanics. *Arch. Rat. Mech. Anal.*, 236(2): 505–576, 2020. [arXiv:1809.06110](#), DOI.
- [17] M. Lewin, E. H. Lieb, and R. Seiringer. Floating Wigner crystal with no boundary charge fluctuations. *Phys. Rev. B*, 100: 035127, July 2019. [arXiv:1905.09138](#), DOI.
- [18] M. Lewin, P. Madsen, and A. Triay. Semi-classical limit of large fermionic systems at positive temperature. *J. Math. Phys.*, 60: 091901, 2019. [arXiv:1902.00310](#), DOI.
- [19] D. Gontier and M. Lewin. Spin symmetry breaking in the translation-invariant Hartree-Fock Uniform Electron Gas. *SIAM J. Math. Anal.*, 51(4): 3388–3423, 2019. [arXiv:1812.07679](#), DOI.
- [20] D. Gontier, C. Hainzl, and M. Lewin. Lower bound on the Hartree-Fock energy of the electron gas. *Phys. Rev. A*, 99: 052501, 2019. [arXiv:1811.12461](#), DOI.
- [21] M. J. Esteban, M. Lewin, and É. Séré. Domains for Dirac-Coulomb min-max levels. *Rev. Mat. Iberoam.*, 35(3): 877–924, 2019. [arXiv:1702.04976](#), DOI.
- [22] M. Lewin. Existence of Hartree-Fock excited states for atoms and molecules. *Lett. Math. Phys.*, 108(4): 985–1006, 2018. [arXiv:1708.00287](#), DOI.
- [23] M. Lewin. Semi-classical limit of the Levy-Lieb functional in Density Functional Theory. *C. R. Math. Acad. Sci. Paris*, 356(4): 449–455, 2018. [arXiv:1706.02199](#), DOI.
- [24] M. Lewin, E. H. Lieb, and R. Seiringer. Statistical mechanics of the Uniform Electron Gas. *J. Éc. polytech. Math.*, 5: 79–116, 2018. [arXiv:1705.10676](#), DOI.
- [25] M. Lewin, P. T. Nam, and N. Rougerie. Gibbs measures based on 1D (an)harmonic oscillators as mean-field limits. *J. Math. Phys.*, 59: 041901, 2018. [arXiv:1703.09422](#), DOI.
- [26] P. Gravejat, M. Lewin, and É. Séré. Derivation of the magnetic Euler-Heisenberg energy. *J. Math. Pures Appl.*, 117: 59–93, 2018. [arXiv:1602.04047](#), DOI.
- [27] S. Fournais, M. Lewin, and J. P. Solovej. The semi-classical limit of large fermionic systems. *Calc. Var. Partial Differ. Equ.* 57–105, 2018. [arXiv:1510.01124](#), DOI.
- [28] M. Lewin, P. Thành Nam, and N. Rougerie. A note on 2D focusing many-boson systems. *Proc. Amer. Math. Soc.*, 145(6): 2441–2454, June 2017. [arXiv:1509.09045](#), DOI.
- [29] S. Fournais, J. Lampart, M. Lewin, and T. Østergaard Sørensen. Coulomb potentials and Taylor expansions in Time-Dependent Density Functional Theory. *Phys. Rev. A*, 93(6): 062510, June 2016. [arXiv:1603.02219](#), DOI.
- [30] J. Lampart and M. Lewin. Semi-classical Dirac vacuum polarisation in a scalar field. *Ann. Henri Poincaré*, 17(8): 1937–1954, 2016. [arXiv:1506.00895](#), DOI.
- [31] M. Lewin, P. T. Nam, and N. Rougerie. The mean-field approximation and the non-linear Schrödinger functional for trapped Bose gases. *Trans. Amer. Math. Soc.*, 368(9): 6131–6157, 2016. [arXiv:1405.3220](#), DOI.
- [32] X. Blanc and M. Lewin. The crystallization conjecture: A review. *EMS Surv. Math. Sci.*, 2(2): 255–306, 2015. [arXiv:1504.01153](#), DOI.
- [33] J. Lampart and M. Lewin. A many-body RAGE theorem. *Comm. Math. Phys.*, 340(3): 1171–1186, 2015. [arXiv:1503.00496](#), DOI.
- [34] M. Lewin, P. T. Nam, and N. Rougerie. Derivation of nonlinear Gibbs measures from many-body quantum mechanics. *J. Éc. polytech. Math.*, 2: 65–115, 2015. [arXiv:1410.0335](#), DOI.
- [35] M. Lewin and E. H. Lieb. Improved Lieb-Oxford exchange-correlation inequality with gradient correction. *Phys. Rev. A*, 91(2): 022507, 2015. [arXiv:1408.3358](#), DOI.
- [36] M. Lewin and S. Rota Nodari. Uniqueness and non-degeneracy for a nuclear nonlinear Schrödinger equation. *NoDEA Nonlinear Differential Equations Appl.*, 22(4): 673–698, 2015. [arXiv:1405.1165](#), DOI.

- [37] M. Lewin, P. T. Nam, and N. Rougerie. Remarks on the quantum de Finetti theorem for bosonic systems. *Appl. Math. Res. Express (AMRX)*, 2015(1): 48–63, 2015. [arXiv:1310.2200](#), DOI.
- [38] M. Lewin and J. Sabin. The Hartree equation for infinitely many particles. I. Well-posedness theory. *Comm. Math. Phys.*, 334(1): 117–170, 2015. [arXiv:1310.0603](#), DOI.
- [39] M. Lewin, P. T. Nam, and B. Schlein. Fluctuations around Hartree states in the mean-field regime. *Amer. J. Math.*, 137(6): 1613–1650, dec 2015. [arXiv:1307.0665](#), DOI.
- [40] M. Lewin, P. T. Nam, S. Serfaty, and J. P. Solovej. Bogoliubov spectrum of interacting Bose gases. *Comm. Pure Appl. Math.*, 68(3): 413–471, march 2015. [arXiv:1211.2778](#), DOI.
- [41] M. Lewin and J. Sabin. The Hartree equation for infinitely many particles. II. Dispersion and scattering in 2D. *Analysis & PDE*, 7(6): 1339–1363, 2014. [arXiv:1310.0604](#), DOI.
- [42] M. Lewin and J. Sabin. A family of monotone quantum relative entropies. *Lett. Math. Phys.*, 104(6): 691–705, 2014. [arXiv:1309.4046](#), DOI.
- [43] R. L. Frank, M. Lewin, E. H. Lieb, and R. Seiringer. Strichartz inequality for orthonormal functions. *J. Eur. Math. Soc. (JEMS)*, 16: 1507–1526, 2014. [arXiv:1306.1309](#), DOI.
- [44] M. Lewin, P. T. Nam, and N. Rougerie. Derivation of Hartree’s theory for generic mean-field Bose systems. *Adv. Math.*, 254: 570–621, March 2014. [arXiv:1303.0981](#), DOI.
- [45] M. Lewin and S. Paul. A numerical perspective on Hartree-Fock-Bogoliubov theory. *ESAIM: M2AN*, 48(1): 53–86, 2014. [arXiv:1206.6081](#), DOI.
- [46] E. Lenzmann and M. Lewin. Dynamical ionization bounds for atoms. *Analysis & PDE*, 6(5): 1183–1211, 2013. [arXiv:1207.6898](#), DOI.
- [47] P. Gravejat, C. Hainzl, M. Lewin, and É. Séré. Construction of the Pauli-Villars-regulated Dirac vacuum in electromagnetic fields. *Arch. Rat. Mech. Anal.*, 208(2): 603–665, May 2013. [arXiv:1204.2893](#), DOI.
- [48] É. Cancès, S. Lahbabi, and M. Lewin. Mean-field models for disordered crystals. *J. Math. Pures Appl.*, 100(2): 241–274, 2013. [arXiv:1203.0402](#), DOI.
- [49] M. Lewin and N. Rougerie. On the binding of polarons in a mean-field quantum crystal. *ESAIM Control Optim. Calc. Var.*, 19(3): 629–656, July 2013. [arXiv:1202.5103](#), DOI.
- [50] M. Lewin and N. Rougerie. Derivation of Pekar’s Polarons from a Microscopic Model of Quantum Crystals. *SIAM J. Math. Anal.*, 45(3): 1267–1301, 2013. [arXiv:1108.5931](#), DOI.
- [51] C. Hainzl, M. Lewin, and C. Sparber. Ground state properties of graphene in Hartree-Fock theory. *J. Math. Phys.*, 53: 095220, 2012. Special issue in honor of E.H. Lieb’s 80th birthday. [arXiv:1203.5016](#), DOI.
- [52] X. Blanc and M. Lewin. Existence of the thermodynamic limit for disordered quantum Coulomb systems. *J. Math. Phys.*, 53: 095209, 2012. Special issue in honor of E.H. Lieb’s 80th birthday. [arXiv:1201.4670](#), DOI.
- [53] M. Lewin. Comment on ‘Solutions to quasi-relativistic multi-configurative Hartree-Fock equations in quantum chemistry’, by C. Arguez and M. Melgaard. *Nonlinear Analysis: Theory, Methods & Applications*, 75: 2988–2991, 2012. [arXiv:1111.4491](#), DOI.
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- [2] M. Lewin, E. H. Lieb, and R. Seiringer. *Density Functional Theory — Modeling, Mathematical Analysis, Computational Methods, and Applications* chapter Universal Functionals in Density Functional Theory, 115–182. Springer, 2023. [arXiv:1912.10424](#), DOI.
- [3] R. L. Frank, D. Gontier, and M. Lewin. *Partial Differential Equations, Spectral Theory, and Mathematical Physics. The Ari Laptev Anniversary Volume*, volume 18 of *EMS Series of Congress Reports* chapter The periodic Lieb–Thirring inequality, 135–154. EMS Publishing House, June 2021. [arXiv:2010.02981](#), DOI.
- [4] M. Lewin, P. T. Nam, and N. Rougerie. *Macroscopic Limits of Quantum Systems*, volume 270 of *Springer Proceedings in Mathematics and Statistics* chapter Blow-up profile of rotating 2D focusing Bose gases, 145–170. Springer, springer edition, 2018. Conference in honor of Herbert Spohn 70th birthday, Munich, Germany, March 20 – April 1, 2017. [arXiv:1802.01854](#), DOI.
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## Proceedings

- [1] M. Lewin, P. T. Nam, and N. Rougerie. Derivation of renormalized Gibbs measures from equilibrium many-body quantum Bose gases. *J. Math. Phys.*, 60(6): 061901, 2019. Proceedings of the 2018 International Congress of Mathematical Physics at Montréal, Canada. [arXiv:1903.01271](#), DOI.
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- [4] M. Lewin. Mean-field limit of Bose systems: rigorous results. In *Proceedings of the International Congress of Mathematical Physics, Santiago de Chile*, 2015. ArXiv e-prints. [arXiv:1510.04407](#).
- [5] P. Gravejat, C. Hainzl, M. Lewin, and É. Séré. Deux modèles effectifs pour les champs électromagnétiques dans le vide de Dirac. In *Séminaire Laurent Schwartz – EDP et applications* Exp. no. 14, 2015-2016. DOI.
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- [17] M. Lewin. On the computation of excited states with MCSCF methods. *Oberwolfach Reports*, 3(4): 2833–2836, 2006. Workshop “Mathematical and Numerical Aspects of Quantum Chemistry Problems”.
- [18] M. Lewin. Solutions of the multiconfiguration equations in quantum chemistry. *Oberwolfach Reports*, 1(3): 1541–1586, 2005. Workshop “Calculus of variations” June, 2004.

## Articles généraux et de vulgarisation

- [1] M. Chupin, J. Dolbeault, M. J. Esteban, and M. Lewin. Une cartographie de la communauté mathématique française. *Matapli – Bulletin de la Société de Mathématiques Appliquées et Industrielles* no. 115 (Mars), p. 51–71 & *La Gazette des Mathématiciens – Bulletin de la Société Mathématique de France* no. 156 (Avril), p. 49–61, 2018.
- [2] M. Lewin. Bretzels, bagels, donuts et... topologie. *CNRS Le Journal*, 2017.
- [3] M. Lewin. Limite de champ moyen et condensation de Bose-Einstein. *Gazette des Mathématiciens*, 139: 35–49, Jan 2014. Société Mathématique de France.
- [4] M. Lewin. Des cristaux et des maths. *CNRS Le Journal*, 2014.

## Thèses

- [1] M. Lewin. Large Quantum Systems: a Mathematical and Numerical Perspective. Habilitation à Diriger des Recherches, University of Cergy-Pontoise, June 2009.
- [2] M. Lewin. *Some nonlinear models in Quantum Mechanics*. PhD thesis, University of Paris-Dauphine, June 2004.

## Autres

- [1] M. Lewin. Théorie spectrale et mécanique quantique. Cours de l'École Polytechnique, 2018.
- [2] M. Lewin. Éléments de théorie spectrale : le Laplacien sur un ouvert borné. Notes de cours de Master 2, 2017.
- [3] M. Lewin. Describing lack of compactness in Sobolev spaces. Lecture notes on *Variational Methods in Quantum Mechanics*, University of Cergy-Pontoise, hal:02450559, 2010.

# EXPOSÉS

## Conférences internationales (sélection)

- 2023** Oct. Mini-workshop on *Mathematics of Many-body Fermionic Systems*, Oberwolfach, Germany  
Sept. Workshop on *Many-Body Quantum Systems*, Oberwolfach, Germany  
Août VIASM-IAMP *summer school and workshop in Mathematical Physics*, Quy Nhon, Vietnam  
Juin Conference *Frontiers in Mathematical Physics*, CY University, Cergy-Pontoise, France  
Juin Conference *Correlations in Mathematical Quantum Mechanics* in honor of Jan Philip Solovej, Copenhagen, Denmark  
Juin Colloquium du laboratoire de physique, ENS Lyon, France  
Mai Colloquium of the Mathematical Institute, LMU Munich, Germany  
Mars *Maxwell Institute Mini-symposium in Analysis and PDEs*, Edinburgh, UK  
Mars Long course at the Conference on *Optimal Transport Theory and Applications to Physics*, Les Houches, France
- 2022** Août Long course at the Conference on *The Statistical Physics of Continuum Particle Systems with Strong Interactions*, Singapore  
Juil. Conference *Advances in Mathematical Physics* in honor of Elliott H. Lieb on his 90th Birthday, Harvard, USA  
Juil. **Invited speaker** at the online ICM 2022. Peut être visualisé sur [youtube](#)  
Mai Conference on *Mathematical results of many-body quantum systems*, Herrsching, Germany  
Avril Online talk at the workshop on *Model Reduction in Quantum Mechanics*, IPAM, University of California Los Angeles, USA  
Mars Conference *CY Days in Nonlinear Analysis*, Cergy-Pontoise, France
- 2021** Nov. Workshop *Inverse Problems and related fields*, Marseille, France  
Août Conference *Solid Math*, Marne La Vallée, France  
Juin IAMP One World Mathematical Physics Seminar, online. Peut être visualisé sur [youtube](#)  
Juin SwissMAP workshop on *Emergent theories for wave turbulence and particle dynamics*, Les Diablerets, Switzerland  
Mai Conference on *Schrödinger equations*, Le Croisic, France  
Avril Eighth Texas Analysis and Mathematical Physics Symposium, online conference at UT Austin, USA
- 2020** Janv. Conference of the GDR *N-Body*, Lille, France
- 2019** Nov. Symposium on *Developments in the Mathematical Sciences*, Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany  
Oct. Conference on *The analysis of complex systems*, CIRM, France  
Sept. Conference on *Density Functionals for Many-Particle Systems: Mathematical Theory and Physical Applications of Effective Equations*, Singapore  
Juil. Minisymposia on *Dirac Hamiltonians with critical singularities*, ICIAM Conference, Valencia, Spain  
Juin Conference on *Mathematical and Numerical Analysis of Electronic Structure Models*, Suzhou, China  
Janv. Kick-off conference of the trimester on *Spectral Methods in Mathematical Physics*, Mittag-Leffler Institute, Stockholm, Sweden
- 2018** Déc. Conference *Results in Contemporary Mathematical Physics* in honor of Rafael Benguria, Santiago, Chile  
Oct. Workshop on the occasion of the *60th birthday of Claude-Alain Pillet*, Montreal, Canada  
Juil. Conference on *Physics and Mathematics of Quantum Field Theory*, Banff International Research Station, Canada  
Juil. *International Congress on Mathematical Physics* (contributed talk), Montréal, Canada

- Juil. Colloquium of the Mathematics Department, LMU Munich, Germany  
 Juin SIAM Conference on *Nonlinear Waves*, Los Angeles, USA  
 Juin Workshop on *The analysis of Dirac equations*, Orsay, France  
 Mai Conference on *Partial Differential Equations in Physics and Materials Science*, Heraklion, Crete  
 Mai Conference on *Recent Results on Quantum Many-Body Systems* (in honor of Heinz Siedentop), Herrsching, Germany  
 Mars Workshop on *Mathematical Methods in Quantum Chemistry*, Oberwolfach, Germany  
**2017** Sept. Workshop on *Quantum Field Theory*, Oberwolfach, Germany  
 Août Conference on *Mathematical challenges in classical & quantum statistical mechanics*, Venice, Italy  
 Mai Workshop *Optimal Transport meets Density Functional Theory*, Jyväskylä, Finland  
 Mars Workshop on *Macroscopic limits of quantum systems*, TU Munich, Germany  
 Fév. Conference *New trends in Mathematical Physics at the interface of Analysis and Probability*, London, UK  
 Janv. Workshop on *Applications of Optimal Transportation in the Natural Sciences*, Oberwolfach, Germany  
**2016** Déc. Workshop on *Evolution Equations*, Valdivia, Chile  
 Oct. Workshop on *Synergies between Mathematical and Computational Approaches to Quantum Many-Body Physics*, ESI Vienna, Austria  
 Sept. Workshop on *Many-Body Quantum Systems and Effective Theories*, Oberwolfach, Germany  
 Août Conference on *Methods of Modern Mathematical Physics* (Young Researcher Symposium on the Occasion of the 70th Birthday of Barry Simon), Fields Institute Toronto, Canada  
 Juin Conference on *New challenges in mathematical modelling and numerical simulation of superfluids*, CIRM Marseille, France  
 Juin Conference on *Spectral Theory and Mathematical Physics*, Univ. Cergy-Pontoise, France  
 Juin Conference on *Mathematical Many-Body Theory and its Applications*, BCAM, Bilbao, Spain  
 Mai Workshop on *Quantum Dynamics & Control*, Institut Henri Poincaré, Paris, France  
 Mai Symposium on *Trends in Mathematical Crystallisation*, Warwick University, UK  
 Janv. *Indo-French conference in Mathematics*, Chennai, India  
**2015** Oct. Conférence “États de la recherche” on *Superconductivity, superfluidity & Vortices*, IHP Paris, France  
 Juil. Plenary speaker at the *International Congress of Mathematical Physics*, Santiago de Chile  
 Juin ANR Meeting on *Spectral and scattering theories in Quantum Field Theory*, Porquerolles, France  
 Juin Workshop on *Mathematical Methods in Quantum Molecular Dynamics*, Oberwolfach, Germany  
 Avril Chemistry workshop on *Advances in electronic structure theory*, Jussieu, Paris, France  
 Mars Séminaire *Monde Quantique*, I.H.E.S., France  
 Fév. Opening lecture of the *Mary Cartwright lecture* by Maria J. Esteban, London Mathematical Society, London, UK  
 Janv. *6th itinerant meeting in PDE*, SISSA, Trieste, Italy  
**2014** Oct. *Spectral Theory* Workshop to celebrate the 70th birthday of Brian Davies, King’s College London, UK  
 Oct. Conference on *Nonlinearity, Transport, Physics, and Patterns*, Fields Institute, Toronto, Canada  
 Sept. Conference *Scaling Limits and Effective Theories in Classical and Quantum Mechanics*, ESI Vienna, Austria  
 Avril Conference *Theoretical and Numerical Aspects of Quantum Transport*, Ålborg, Denmark  
 Mars Conference *Mathematical and Numerical Methods for Complex Quantum Systems*, Univ. Illinois Chicago, USA  
 Mars Warwick EPSRC Symposium on *Statistical Mechanics: Many-Body Quantum Systems*, UK  
**2013** Oct. Workshop on *Disordered Quantum Many-Body Systems*, Banff, Canada  
 Oct. Conference *Mathématiques pour le graphène*, Univ. Joseph Fourier, Grenoble, France  
 Sept. Conference *Analytical and quantum mechanical aspects of Schrodinger and Dirac operators*, Pisa, Italy

- Juin Journées E.D.P., Biarritz, France
- Mai Conference on *Conical Intersections in Mathematical Physics*, Institut Henri Poincaré, Paris
- Mai Workshop on *Analytical Aspects of Mathematical Physics*, ETH Zürich, Switzerland
- Avril Workshop on *Numerical Challenges in Relativistic Quantum Chemistry*, Institut Henri Poincaré, Paris, France
- Avril *EMS Weekend*, session on *Partial Differential Equations and Applications*, Århus, Denmark
- Mars Conference *Analysis and Stochastics in Complex Physical Systems*, Leipzig, Germany
- Fév. 5th meeting of the GDR “Quantum Dynamics”, Lille, France
- 2012** Oct. Conference on *Recent Developments in the Mathematical Analysis of Large Systems*, Erwin Schrödinger Institute, Vienna, Austria
- Sept. Conference on *New Perspectives in Nonlinear PDEs*, Rome, Italy
- Août VMS–SMF Joint Congress, Session on PDE, Hue, Vietnam
- Août Workshop on *New developments in relativistic quantum mechanics and applications*, Newton Institute, Cambridge, UK
- Juil. *Mathematics of Many-Particle Systems* (conference in honor of Elliott H. Lieb, on the occasion of his 80th birthday), Berlin, Germany
- Juil. *6th European Mathematical Congress (EMS Prize talk)*, Kraków, Poland
- Mai Workshop on *Mathematical and Numerical Analysis of Electronic Structure Models*, Beijing, China
- Mai Workshop on *Quantum Many-Body Systems*, Montréal, Canada
- Avril *Spectral Days*, Munich, Germany
- 2011** Oct. *EMS Week End*, session on *PDEs and applications to mechanics and physics*, Bilbao, Spain
- Juil. Thematic Minisymposia on *Quantum Modeling in Molecular Simulation* and on *Current interests in Mathematical Physics, International Congress on Industrial and Applied Mathematics (ICIAM 2011)*, Vancouver, Canada
- Juil. Conference *Intellectual Challenges in Multiscale Modelling of Solids*, University of Oxford, UK
- Juin Workshop *Mathematical Methods in Quantum Chemistry*, Oberwolfach, Germany
- Fév. Fourth School and Workshop on *Mathematical Methods in Quantum Mechanics*. Bressanone, Italy
- 2010** Sept. Conference on *New Approaches in Many-Electron Theory*, Max-Planck-Institut für Polymerforschung, Mainz, Germany
- Sept. QMATH11 (**plenary speaker**), Hradec Králové, Czech Republic
- Août ICM 2010 Satellite Conference on *Quantum Systems*, Chennai, India
- Juin Workshop on *Matter and Radiation*, Erwin Schrödinger Institute, Vienna, Austria
- Mai *SIAM Conference on Mathematical Aspects of Material Sciences*, Session on *Electronic structure*, Philadelphia, USA
- Avril *2010 British Mathematical Colloquium and British Applied Mathematics Colloquium*, Session *Spectral Theory*, Edinburgh, Scotland
- Mars *Annual meeting of the German Math. Society (DMV)*, Session *Mathematical methods in quantum chemistry and electronic structure theory*, Munich, Germany
- 2009** Sept. *International Conference on Numerical Analysis and Applied Mathematics*, Symposium on *Numerical methods and their applications in molecular simulation*, Rethymnon, Crete
- Sept. Conference *Mathematics of Complex Quantum Systems*, Oberwolfach, Germany
- Août Banff workshop on the *Analysis of nonlinear wave equations and applications in engineering*, Banff, Canada
- 2008** Sept. IMA Annual Program Year Workshop *Mathematical and Algorithmic Challenges in Electronic Structure Theory*, Minneapolis, USA
- Juil. *XI Encuentro de Matematica y sus Aplicaciones (plenary speaker)*, Quito, Ecuador
- Juin *Canadian-French Conference*, Montréal, Canada
- 2007** Sept. *QMATH 10*, Moeiciu, Romania
- Août 4th Danish Symposium on *Applied Analysis*, Copenhagen, Denmark

- Juil. *International Conference on Scientific Computation and Differential Equations (SciCADE 2007)*.  
 Symposium *Applications to Chemistry*, Saint-Malo, France
- Mars *Relativistic Effects in Heavy Elements*, Ottrott, France
- Fév. Workshop *Multiscale and Variational Methods in Material Science and Quantum Theory of Solids*, Oberwolfach, Germany
- Janv. Conference *Semi-classical Days XIV*, CIRM, Marseille, France
- 2006** Oct. Conference *Mathematical and Numerical Aspects of Quantum Chemistry Problems*, Oberwolfach, Germany
- Juil. Conference *Mathematics in Chemistry*, Lisbon, Portugal
- Juin Workshop on *Quantum Mechanics of Complex Systems*, Erwin Schrödinger Institute, Vienna, Austria
- 2005** Déc. Conference *Topological and Variational Methods in Partial Differential Equations*, Guanajuato, Mexico
- Nov. Conference *Mathematical Methods for Ab Initio Quantum Chemistry*, Nice, France
- Avril Fourth international conference on *Analysis and Quantum*, München, Germany
- 2004** Déc. Conference of the 2004-2005 Warwick EPSRC Symposium on *Mathematical challenges in quantum chemistry*, Warwick, UK
- Août Conference of the 2004-2005 Warwick EPSRC Symposium on *Large many-body systems*, Warwick, UK
- Juil. Satellite conference of the 4th European Congress of Mathematics (ECM), *Spectrum and Quantum Mechanics*, Stockholm, Sweden
- Juin Workshop on *Calculus of variations*, Oberwolfach, Germany
- 2003** Déc. Meeting of the EU network “Analysis and Quantum”, ESI, Vienna, Austria
- Fév. *Applied Mathematics and Applications of Mathematics (AMAM)*, Symposium of *Quantum Chemistry*, Nice, France