

# 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

2017 – 2022 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

2014 – Éditeur pour *Letters in Mathematical Physics*  
2013 – Éditeur pour *Mathematical Models and Methods in Applied Sciences (M3AS)*

## Responsabilités administratives

Juil. 2015 – Membre élu du conseil d'administration de la SMAI  
Janv. 2015 – Membre élu du conseil exécutif de l'association internationale de physique mathématique (IAMP)  
Oct. 2014 – 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" ([webpage](#))

## Comités & autres

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 – 2022 PI of the ERC Consolidator Grant *Mathematics of Density Functional Theory*, H2020 no. 725528.
- 2010 – 2015 PI of the ERC Starting Grant *Mathematics and Numerics of Infinite Quantum Systems*, FP7/2007–2013 no. 258023.
- 2010 – 2014 Coordinateur du projet ANR *NoNAP* (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 *ACCQUAREL* (Approches Computationnelles en Chimie QUAntique RELativiste)

## Étudiants

### Post-Docs

- Luca Nenna, Sept. 2017 – Août 2019
- 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

### Thésards

- Louis Garrigue, Sept. 2017 –
- Arnaud Triay-Alcouffe, Sept. 2015 –
- Raphaël Ducatez, Sept. 2015 –
- 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

- Louis Garrigue, été 2017 (ENS)
- Raphaël Ducatez, été 2015 (ENS)
- Arnaud Triay, étés 2013, 2014 & 2015 (ENS Lyon)
- Thomas Dumas, été 2013 (master Cergy)
- Julien Ricaud, été 2012 (master Paris 6)
- Julien Sabin, étés 2008 & 2009 (ENS Lyon & master Dauphine)

## Enseignements récents

## Cours

- 2016 – 2019 Cours et petites Classes, École Polytechnique
- 2007 – 2017 *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 thésards et post-doctorants

- 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*, 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

- 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

- 2017 – Co-organisateur du groupe de travail “ESCAPADE” en Analyse et Probabilités du CEREMADE, avec Laure Dumaz
- 2014 – Co-organisateur du séminaire mensuel “Problèmes spectraux” du GDR Dynamique Quantique, Institut Henri Poincaré
- 2005 – 2014 Co-organisateur du groupe de travail de physique mathématique, Université de Cergy-Pontoise

## 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](#)
- 2014 Membre de l’équipe communication au CNRS pour l’année de la cristallographie

## PUBLICATIONS

### Preprints

- [1] M. Lewin, P. T. Nam, and N. Rougerie. Blow-up profile of rotating 2D focusing Bose gases. *ArXiv preprint*, 2018. [arXiv:1802.01854](#).
- [2] M. Lewin. Semi-classical limit of the Levy-Lieb functional in Density Functional Theory. *ArXiv e-prints*, 2017. [arXiv:1706.02199](#).
- [3] M. Lewin, P. Nam, and N. Rougerie. Gibbs measures based on 1D (an)harmonic oscillators as mean-field limits. *ArXiv e-prints*, 2017. [arXiv:1703.09422](#).
- [4] M. Lewin, P. Nam, and N. Rougerie. Bose Gases at Positive Temperature and Non-Linear Gibbs Measures. In *Proceedings of the International Congress of Mathematical Physics*, 2015. ArXiv e-prints. [arXiv:1602.05166](#).
- [5] M. Lewin. Mean-field limit of Bose systems: rigorous results. In *Proceedings of the International Congress of Mathematical Physics*, 2015. ArXiv e-prints. [arXiv:1510.04407](#).
- [6] S. Fournais, M. Lewin, and J. P. Solovej. The semi-classical limit of large fermionic systems. *ArXiv e-prints*, 2015. [arXiv:1510.01124](#).

### Articles acceptés ou publiés

- [1] 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](#).
- [2] M. Lewin. Existence of Hartree-Fock excited states for atoms and molecules. *Lett. Math. Phys.*, online first, 2017. [arXiv:1708.00287](#), DOI.
- [3] M. J. Esteban, M. Lewin, and E. Séré. Domains for Dirac-Coulomb min-max levels. *Rev. Mat. Iberoam.*, in press, 2017. [arXiv:1702.04976](#).
- [4] P. Gravejat, M. Lewin, and É. Séré. Derivation of the magnetic Euler-Heisenberg energy. *J. Math. Pures Appl.*, in press, 2017. [arXiv:1602.04047](#), DOI.
- [5] 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.
- [6] 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.
- [7] 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.
- [8] 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.
- [9] X. Blanc and M. Lewin. The Crystallization Conjecture: A Review. *EMS Surv. Math. Sci.*, 2(2): 219–306, 2015. [arXiv:1504.01153](#), DOI.
- [10] J. Lampart and M. Lewin. A many-body RAGE theorem. *Comm. Math. Phys.*, 340(3): 1171–1186, 2015. [arXiv:1503.00496](#), DOI.
- [11] 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.
- [12] 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.
- [13] 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.
- [14] 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.

- [15] 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.
- [16] 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.
- [17] 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.
- [18] 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.
- [19] M. Lewin and J. Sabin. A family of monotone quantum relative entropies. *Lett. Math. Phys.*, 104(6): 691–705, 2014. [arXiv:1309.4046](#), DOI.
- [20] 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.
- [21] 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.
- [22] M. Lewin and S. Paul. A Numerical Perspective on Hartree-Fock-Bogoliubov Theory. *ESAIM: M2AN*, 48(1): 53–86, 2014. [arXiv:1206.6081](#), DOI.
- [23] E. Lenzmann and M. Lewin. Dynamical ionization bounds for atoms. *Analysis & PDE*, 6(5): 1183–1211, 2013. [arXiv:1207.6898](#), DOI.
- [24] P. Gravejat, C. Hainzl, M. Lewin, and E. 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.
- [25] 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.
- [26] 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.
- [27] 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.
- [28] 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.
- [29] 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.
- [30] 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.
- [31] R. L. Frank, M. Lewin, E. H. Lieb, and R. Seiringer. A positive density analogue of the Lieb-Thirring inequality. *Duke Math. J.*, 162(3): 435–495, 2012. [arXiv:1108.4246](#), DOI.
- [32] L. Boulton, N. Boussaid, and M. Lewin. Generalised Weyl theorems and spectral pollution in the Galerkin method. *J. Spect. Theory*, 2(4): 329–354, 2012. [arXiv:1011.3634](#), DOI.
- [33] E. Lenzmann and M. Lewin. On singularity formation for the  $L^2$ -critical Boson star equation. *Nonlinearity*, 24(12): 3515, 2011. [arXiv:1103.3140](#), DOI.
- [34] R. L. Frank, M. Lewin, E. H. Lieb, and R. Seiringer. Energy Cost to Make a Hole in the Fermi Sea. *Phys. Rev. Lett.*, 106(15): 150402, Apr 2011. [arXiv:1102.1414](#), DOI.
- [35] M. Lewin. Geometric methods for nonlinear many-body quantum systems. *J. Funct. Anal.*, 260: 3535–3595, 2011. [arXiv:1009.2836](#), DOI.
- [36] P. Gravejat, M. Lewin, and É. Séré. Renormalization and asymptotic expansion of Dirac’s polarized vacuum. *Commun. Math. Phys.*, 306(1): 1–33, 2011. [arXiv:1004.1734](#), DOI.
- [37] M. J. Esteban, M. Lewin, and A. Savin. Symmetry breaking of relativistic multiconfiguration methods in the nonrelativistic limit. *Nonlinearity*, 23: 767–791, 2010. [arXiv:0910.3932](#), DOI.
- [38] C. Hainzl, E. Lenzmann, M. Lewin, and B. Schlein. On blowup for time-dependent generalized Hartree-Fock equations. *Ann. Henri Poincaré*, 11(6): 1023–1052, 2010. [arXiv:0909.3043](#), DOI.

- [39] É. Cancès and M. Lewin. The dielectric permittivity of crystals in the reduced Hartree-Fock approximation. *Arch. Ration. Mech. Anal.*, 197(1): 139–177, 2010. [arXiv:0903.1944](#), DOI.
- [40] M. Lewin and É. Séré. Spectral pollution and how to avoid it (with applications to Dirac and periodic Schrödinger operators). *Proc. London Math. Soc.*, 100(3): 864–900, 2010. [arXiv:0812.2153](#), DOI.
- [41] E. Lenzmann and M. Lewin. Minimizers for the Hartree-Fock-Bogoliubov theory of neutron stars and white dwarfs. *Duke Math. J.*, 152(2): 257–315, 2010. [arXiv:0809.2560](#), DOI.
- [42] C. Hainzl, M. Lewin, and É. Séré. Existence of atoms and molecules in the mean-field approximation of no-photon quantum electrodynamics. *Arch. Ration. Mech. Anal.*, 192(3): 453–499, 2009. [arXiv:math-ph/0606001](#), DOI.
- [43] M. Lewin and R. Seiringer. Strongly correlated phases in rapidly rotating Bose gases. *J. Stat. Phys.*, 137(5-6): 1040–1062, Dec 2009. [arXiv:0906.0741](#), DOI.
- [44] C. Hainzl, M. Lewin, and J. P. Solovej. The thermodynamic limit of quantum Coulomb systems. Part II. Applications. *Advances in Math.*, 221: 488–546, 2009. [arXiv:0806.1709](#), DOI.
- [45] C. Hainzl, M. Lewin, and J. P. Solovej. The thermodynamic limit of quantum Coulomb systems. Part I. General theory. *Advances in Math.*, 221: 454–487, 2009. [arXiv:0806.1708](#), DOI.
- [46] M. Ghimenti and M. Lewin. Properties of periodic Hartree-Fock minimizers. *Calc. Var. Partial Differential Equations*, 35(1): 39–56, 2009. [arXiv:0803.3269](#), DOI.
- [47] P. Gravejat, M. Lewin, and É. Séré. Ground state and charge renormalization in a nonlinear model of relativistic atoms. *Commun. Math. Phys.*, 286(1): 179–215, 2009. [arXiv:0712.2911](#), DOI.
- [48] J. Dolbeault, P. Felmer, and M. Lewin. Stability of the Hartree-Fock model with temperature. *Math. Models Methods Appl. Sci.*, 19(3): 347–367, 2009. DOI.
- [49] É. Cancès, A. Deleurence, and M. Lewin. A new approach to the modelling of local defects in crystals: the reduced Hartree-Fock case. *Commun. Math. Phys.*, 281(1): 129–177, 2008. [arXiv:math-ph/0702071](#), DOI.
- [50] C. Hainzl, M. Lewin, and R. Seiringer. A nonlinear model for relativistic electrons at positive temperature. *Rev. Math. Phys.*, 20(10): 1283–1307, 2008. [arXiv:0802.4054](#), DOI.
- [51] M. J. Esteban, M. Lewin, and É. Séré. Variational methods in relativistic quantum mechanics. *Bull. Amer. Math. Soc. (N.S.)*, 45(4): 535–593, 2008. [arXiv:0706.3309](#), DOI.
- [52] É. Cancès, A. Deleurence, and M. Lewin. Non-perturbative embedding of local defects in crystalline materials. *J. Phys.: Condens. Matter*, 20: 294213, 2008. [arXiv:0706.0794](#), DOI.
- [53] C. Hainzl, M. Lewin, and J. P. Solovej. The mean-field approximation in quantum electrodynamics: the no-photon case. *Comm. Pure Appl. Math.*, 60(4): 546–596, 2007. [arXiv:math-ph/0503075](#), DOI.
- [54] C. Hainzl, M. Lewin, É. Séré, and J. P. Solovej. A minimization method for relativistic electrons in a mean-field approximation of quantum electrodynamics. *Phys. Rev. A*, 76: 052104, 2007. [arXiv:0706.1486](#), DOI.
- [55] É. Cancès, M. Lewin, and G. Stoltz. The electronic ground-state energy problem: a new reduced density matrix approach. *J. Chem. Phys.*, 125(6): 64101, 2006. [arXiv:quant-ph/0602042](#), DOI.
- [56] M. Lewin. Solution of a mountain pass problem for the isomerization of a molecule with one free atom. *Ann. Henri Poincaré*, 7(2): 365–379, 2006. DOI.
- [57] É. Cancès, H. Galicher, and M. Lewin. Computing electronic structures: a new multiconfiguration approach for excited states. *J. Comput. Phys.*, 212(1): 73–98, 2006. DOI.
- [58] C. Hainzl, M. Lewin, and É. Séré. Self-consistent solution for the polarized vacuum in a no-photon QED model. *J. Phys. A*, 38(20): 4483–4499, 2005. [arXiv:physics/0404047](#), DOI.
- [59] C. Hainzl, M. Lewin, and C. Sparber. Existence of global-in-time solutions to a generalized Dirac-Fock type evolution equation. *Lett. Math. Phys.*, 72(2): 99–113, 2005. [arXiv:math-ph/0412018](#), DOI.

- [60] C. Hainzl, M. Lewin, and É. Séré. Existence of a stable polarized vacuum in the Bogoliubov-Dirac-Fock approximation. *Commun. Math. Phys.*, 257(3): 515–562, 2005. [arXiv:math-ph/0403005](#), DOI.
- [61] M. Lewin. Solutions of the multiconfiguration equations in quantum chemistry. *Arch. Ration. Mech. Anal.*, 171(1): 83–114, 2004. DOI.
- [62] M. Lewin. A mountain pass for reacting molecules. *Ann. Henri Poincaré*, 5(3): 477–521, 2004. DOI.
- [63] M. Lewin. The multiconfiguration methods in quantum chemistry: Palais-Smale condition and existence of minimizers. *C. R. Math. Acad. Sci. Paris*, 334(4): 299–304, 2002. DOI.

## Chapitres de livres

- [1] M. Lewin and É. Séré. *Many-Electron Approaches in Physics, Chemistry and Mathematics* chapter Spurious Modes in Dirac Calculations and How to Avoid Them, 31–52. Mathematical Physics Studies. Springer International Publishing, 2014. [arXiv:1306.5401](#), DOI.

## Proceedings

- [1] P. Gravejat, C. Hainzl, M. Lewin, and E. 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.
- [2] M. Lewin. A nonlinear variational problem in relativistic quantum mechanics. In R. Latala, A. Rucinski, P. Strzelecki, J. Swiatkowski, D. Wrzosek, and P. Zakrzewski, editors, *Proceedings of the 6th European Congress of Mathematics, Krakow (Poland), July 2012*. EMS, 2014. [arXiv:1209.2786](#).
- [3] P. Gravejat, C. Hainzl, M. Lewin, and E. Séré. Two Hartree-Fock models for the vacuum polarization. In *Proceedings of the “Journées E.D.P.”, June 4–8, 2012, Biarritz (France)*, 2012. [arXiv:1209.6338](#).
- [4] É. Cancès, S. Lahbabi, and M. Lewin. Mean-field electronic structure models for disordered materials. In A. Jensen, editor, *XVIIth International Congress on Mathematical Physics* 549–557. World Sci. Publ., 2012. [arXiv:1203.0402](#), DOI.
- [5] M. Lewin. Gaz de bosons dans le régime de champ moyen : les théories de Hartree et Bogoliubov. In *Séminaire Laurent Schwartz – EDP et applications*. IHÉS, 2012-2013. Exp. no 3. DOI.
- [6] É. Cancès, M. Lewin, and G. Stoltz. The microscopic origin of the macroscopic dielectric permittivity of crystals: A mathematical viewpoint. In B. Engquist, O. Runborg, and Y. Tsai, editors, *Numerical Analysis of Multiscale Computations*, volume 82 of *Lecture Notes in Computational Science and Engineering* 87–125. Springer, 2011. Proceedings of a Winter Workshop at the Banff International Research Station 2009. [arXiv:1010.3494](#), DOI.
- [7] M. Lewin. Renormalization of Dirac’s polarized vacuum. In P. Exner, editor, *Mathematical Results In Quantum Physics* 45–59. World Scientific Publishing, 2011. Proceedings of the QMath 11 Conference, Hradec Kralove, Czech Republic, 6 –10 September 2010. [arXiv:1010.0075](#).
- [8] M. Lewin. How much energy does it cost to make a hole in the fermi sea? *Oberwolfach Reports*, 8(2): 1790–1793, 2011. Workshop “Mathematical Methods in Quantum Chemistry”.
- [9] M. Lewin. Sur l’effondrement dynamique des étoiles quantiques pseudo-relativistes. In *Séminaire Laurent Schwartz*. École Polytechnique, April 2011. DOI.
- [10] C. Hainzl, M. Lewin, and J. P. Solovej. The thermodynamic limit of quantum Coulomb systems: A new approach. In I. Beltita, G. Nenciu, and R. Purice, editors, *Mathematical results in Quantum Mechanics: Proceedings of the QMath10 Conference*. World Scientific, 2008. [arXiv:0806.2436](#), DOI.
- [11] M. Lewin. On the computation of excited states with MCSCF methods. *J. Math. Chem.*, 44(4): 967–980, 2008. Conference “Mathematical Methods for Ab Initio Quantum Chemistry”, Nice (FRANCE), Nov. 2005. DOI.
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- [14] 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. Lewin. Bretzels, bagels, donuts et... topologie. CNRS Le Journal, 2017.
- [2] M. Lewin. Limite de champ moyen et condensation de Bose-Einstein. *Gazette des Mathématiciens*, 139: 35–49, Jan 2014. Société Mathématique de France.
- [3] 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. Éléments de théorie spectrale : le Laplacien sur un ouvert borné. Notes de cours de Master 2, 2017.
- [2] M. Lewin. Post-Hartree-Fock Methods and Excited States Modeling. Encyclopedia of Applied and Computational Mathematics, Springer-Verlag, 2012.

# EXPOSÉS

## Conférences internationales (sélection)

- 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 *Supraconductivity, 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*. Bresanone, 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
- 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*, Munich, 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