

# Mathieu LEWIN

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Born on November 14th, 1977, in Senlis, France

## Positions

- Oct. 2014 – CNRS position (Directeur de Recherche)  
CEREMADE, Université Paris-Dauphine
- Sept. 2017 – Part-time Professor  
École Polytechnique, Palaiseau
- Oct. 2005 – Sept. 2014 CNRS position (Chargé de Recherche)  
Mathematics Department, Université de Cergy-Pontoise
- Mar. 2005 – Aug. 2005 Post-doc INRIA  
CERMICS, École Nationale des Ponts et Chaussées, with Éric Cancès
- Aug. 2004 – Feb. 2005 EU Post-doc  
University of Copenhagen (Denmark), with Jan Philip Solovej

## Education and Qualifications

- June 2009 Habilitation à diriger des recherches, Université de Cergy-Pontoise
- June 2004 Ph.D. with Éric Séré, Université Paris Dauphine
- Sept. 1998 – Aug. 2002 Student of the École Normale Supérieure de Cachan

## Honors and Awards

- 2017 – 2022 Consolidator Grant of the European Research Council (ERC)
- 2015 Plenary speaker at the International Congress of Mathematical Physics
- 2012 EMS Prize
- 2010 – 2015 Starting Grant of the European Research Council (ERC)

## Editorial Activities

- 2014 – Editor for *Letters in Mathematical Physics*
- 2013 – Editor for *Mathematical Models and Methods in Applied Sciences (M3AS)*

## Duties

- July 2015 – Elected member of the Administration Council of the French Association of Applied and Industrial Mathematics (SMAI)
- Jan. 2015 – Elected member of the Executive Committee of the International Association of Mathematical Physics (IAMP)
- Oct. 2014 – Scientific Manager for Interdisciplinarity at the CNRS Institute of Mathematics
- 2010 – 2014 Elected member of the Administration Council of the *Institut Henri Poincaré*
- 2010 – 2014 Local representative at Cergy of the SMF and SMAI
- 2008 – 2017 Local representative of the french network on “Quantum Dynamics” ([webpage](#))

## Committees & other duties

- 2015 & 2016 Member of the mathematics & computer science committee of the French National Research Agency (ANR)
- 2015 & 2016 President of the hiring committee for assistant professor positions in Analysis at the university of Paris-Dauphine

## Networks & Grants

- 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 Coordinator of the ANR project *NoNAP* (Nonlinear Methods in Atomic and Nuclear Physics)
- 2010 – 2011 Grant PHC-Alliance obtained in collaboration with Lyonell Boulton (Heriot Watt University, Scotland)
- 2005 – 2009 Member of the ANR project *ACCQUAREL* (Computational Approaches in Relativistic Quantum Chemistry)

## Students

### Post-Docs

- Luca Nenna, Sept. 2017 – Aug. 2019
- Faizan Nazar, Jan. 2017 – Aug. 2019
- Jonas Lampart, Jan. 2014 – Sept. 2016
- Simona Rota-Nodari, Oct. 2012 – Sept. 2013
- Phan Thành Nam, Oct. 2011 – Sept. 2013
- Nicolas Rougerie, Dec. 2010 – Sept. 2011
- Marco Ghimenti, 2007
- Guillaume Legendre (with É. Séré), Nov. 2006 – Aug. 2007

### PhD students

- Louis Garrigue, Sept. 2017 –
- Arnaud Triay-Alcouffe, Sept. 2015 –
- Raphaël Ducatez, Sept. 2015 –
- Julien Ricaud, Oct. 2012 – June 2017
- Salma Lahbabi, with Éric Cancès, Oct. 2010 – July 2013
- Julien Sabin, Sept. 2010 – Dec. 2013
- Séverine Paul, Sept. 2008 – Oct. 2012
- Co-advisor of Amélie Deleurence (PhD with Éric Cancès), Sept. 2005 – Dec. 2008

### Master & others

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

## Recent Teaching Activities

## Courses

- 2016 – 2019 Various courses in Analysis, École Polytechnique
- 2007 – 2017 Master course in Mathematical Physics (with Éric Cancès), Univ. Paris Pierre & Marie Curie, [web](#)
- 2017 Master course in Mathematical Physics, Univ. Pierre & Marie Curie, [web](#)
- 2014 & 2015 Short Analysis course, École Normale Supérieure
- 2006 – 2016 PDE & Optimization (with Frédéric Legoll), École des Ponts - Paris Tech, [web](#)

## Lectures for young researchers

- July 2017 *An introduction to critical point theory, with applications to quantum mechanics* (6h), Summerschool on *Current topics in Mathematical Physics*, Univ. Zürich, Switzerland
- 2016 Graduate Analysis Course, Université Paris-Dauphine
- June 2015 Lecture at IHES (in French) on *Nonlinear Gibbs measures and their derivation from quantum mechanics*, can be seen on [youtube](#)
- Feb. 2015 *Open quantum systems and effective equations* (6h), Winterschool, Research Training Group 1838 on *Spectral Theory and Dynamics of Quantum Systems* (Univ. Stuttgart & Tübingen), Freudenstadt, Germany
- July 2013 *Mathematical foundations of quantum mechanics* (4h), Summerschool “Mathématiques – Chimie – Calcul Haute Performance”, Institut du Calcul et de la Simulation (Univ. P. & M. Curie), Roscoff, France
- Jan. 2012 *Nonlinear equations with fractional powers of the Laplacian and applications to quantum mechanics* (8h with Enno Lenzmann), Università di Pisa, Italy
- Aug. 2011 *Geometric methods for nonlinear many-body quantum systems* (4h), Summerschool on *Current topics in Mathematical Physics*, Erwin Schrödinger Institute, Vienna, Austria

## Organization of events

### Long Programs

- 15 Apr. – 13 July 2013 (with Maria J. Esteban) Thematic Trimester *Variational and Spectral Methods in Quantum Mechanics*, Institut Henri Poincaré, [web](#)
- 2008 Coordinator of the semester *Systèmes Quantiques, Systèmes Complexes*, Université de Cergy-Pontoise

## Conferences

- 30 June – 4 July 2014 (with R. L. Frank), Conference *Effective Equations in Mathematical Physics*, Mittag Leffler Institute, Stockholm, Sweden
- 14 – 18 Apr. 2014 (with 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 Aug. 2012 (with M. Griesemer) Session *Quantum many-body theory and condensed matter physics*, International Congress on Mathematical Physics, Ålborg, Denmark
- 21 – 25 June 2010 (with É. Séré) Conference *Mathematical Aspects of Quantum Electrodynamics*, Institut Henri Poincaré, Paris, France
- 28 May 2009 Session *Applications to Quantum Chemistry*, Conference SCICADE 09, Beijing, China
- 21 – 25 Apr. 2008 Conference *Quantum Statistical Physics and Information Theory*, Université de Cergy-Pontoise
- 31 Jan. – 1 Feb. 2008 (with F. Germinet & L. Bruneau) Conference *Spectral Problems in Quantum Mechanics*, Université de Cergy-Pontoise
- July 2007 (with G. Turinici) Session *Computational issues in Relativistic Quantum Chemistry*, ICIAM, Zurich, Switzerland
- 3 – 6 Sept. 2006 (with 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

## Schools

- 3 Aug. – 7 Aug. 2015 (with 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 (with M.J. Esteban & R. Seiringer), Summerschool *Current topics in Mathematical Physics*, CIRM Marseille, France

## Seminars

- 2017 – Co-organizer of the working group in Analysis and Probability, with Laure Dumaz
- 2014 – Co-organizer of the monthly seminar on “Spectral Problems” of the GDR Quantum Dynamics, Institut Henri Poincaré
- 2005 – 2014 Co-organizer of the Mathematical Physics seminar, Université de Cergy-Pontoise

## Others activities

- 2016–17 Talks about ERC grants in mathematics at the Polish Academy of Science (2016), for a training of CNRS managers (2017) and at the celebration of the 10 years anniversary of ERC at CNRS, with EU13 countries (2017), [webpage](#)
- 2014 Member of a communication team at CNRS about the year of cristallography

## PUBLICATIONS

### Preprints

- [1] M. Lewin. Semi-classical limit of the Levy-Lieb functional in Density Functional Theory. *ArXiv e-prints*, 2017. [arXiv:1706.02199](#).
- [2] 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](#).
- [3] 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](#).
- [4] 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](#).
- [5] S. Fournais, M. Lewin, and J. P. Solovej. The semi-classical limit of large fermionic systems. *ArXiv e-prints*, 2015. [arXiv:1510.01124](#).

### Published or Accepted Articles

- [1] M. Lewin. Existence of Hartree-Fock excited states for atoms and molecules. *Lett. Math. Phys.*, online first, 2017. [arXiv:1708.00287](#), DOI.
- [2] M. Lewin, E. H. Lieb, and R. Seiringer. Statistical Mechanics of the Uniform Electron Gas. *J. Éc. polytech. Math.*, in press, 2017. [arXiv:1705.10676](#).
- [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.
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- [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.

## Book Chapters

- [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. Latała, 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.
- [12] M. Lewin. The thermodynamic limit of Quantum Coulomb Systems. *Oberwolfach Reports*, 4(1): 399–400, 2007. Workshop “Multiscale and Variational Methods in Material Science and Quantum Theory of Solids”.
- [13] 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”.



- [14] M. Lewin. Solutions of the multiconfiguration equations in quantum chemistry. *Oberwolfach Reports*, 1(3): 1541–1586, 2005. Workshop “Calculus of variations” June, 2004.

### General Audience Articles

- [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.

### Thesis

- [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.

### Others

- [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.

# TALKS

## International Conferences (selection)

- 2017** Aug. Conference on *Mathematical challenges in classical & quantum statistical mechanics*, Venice, Italy  
May Workshop *Optimal Transport meets Density Functional Theory*, Jyväskylä, Finland  
Mar. Workshop on *Macroscopic limits of quantum systems*, TU Munich, Germany  
Feb. Conference *New trends in Mathematical Physics at the interface of Analysis and Probability*, London, UK  
Jan. Workshop on *Applications of Optimal Transportation in the Natural Sciences*, Oberwolfach, Germany
- 2016** Dec. 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  
Aug. Conference on *Methods of Modern Mathematical Physics* (Young Researcher Symposium on the Occasion of the 70th Birthday of Barry Simon), Fields Institute Toronto, Canada  
June Conference on *New challenges in mathematical modelling and numerical simulation of superfluids*, CIRM Marseille, France  
June Conference on *Spectral Theory and Mathematical Physics*, Univ. Cergy-Pontoise, France  
June Conference on *Mathematical Many-Body Theory and its Applications*, BCAM, Bilbao, Spain  
May Workshop on *Quantum Dynamics & Control*, Institut Henri Poincaré, Paris, France  
May Symposium on *Trends in Mathematical Crystallisation*, Warwick University, UK  
Jan. *Indo-French conference in Mathematics*, Chennai, India
- 2015** Oct. Conférence “États de la recherche” on *Superconductivity, superfluidity & Vortices*, IHP Paris, France  
July Plenary speaker at the *International Congress of Mathematical Physics*, Santiago de Chile  
June ANR Meeting on *Spectral and scattering theories in Quantum Field Theory*, Porquerolles, France  
June Workshop on *Mathematical Methods in Quantum Molecular Dynamics*, Oberwolfach, Germany  
Apr. Chemistry workshop on *Advances in electronic structure theory*, Jussieu, Paris, France  
Mar. Séminaire *Monde Quantique*, I.H.E.S, France  
Feb. Opening lecture of the *Mary Cartwright lecture* by Maria J. Esteban, London Mathematical Society, London, UK  
Jan. *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  
Apr. Conference *Theoretical and Numerical Aspects of Quantum Transport*, Ålborg, Denmark  
Mar. Conference *Mathematical and Numerical Methods for Complex Quantum Systems*, Univ. Illinois Chicago, USA  
Mar. 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  
June Journées E.D.P., Biarritz, France

- May Conference on *Conical Intersections in Mathematical Physics*, Institut Henri Poincaré, Paris
- May Workshop on *Analytical Aspects of Mathematical Physics*, ETH Zürich, Switzerland
- Apr. Workshop on *Numerical Challenges in Relativistic Quantum Chemistry*, Institut Henri Poincaré, Paris, France
- Apr. *EMS Weekend*, session on *Partial Differential Equations and Applications*, Århus, Denmark
- Mar. Conference *Analysis and Stochastics in Complex Physical Systems*, Leipzig, Germany
- Feb. 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
- Aug. VMS-SMF Joint Congress, Session on PDE, Hue, Vietnam
- Aug. Workshop on *New developments in relativistic quantum mechanics and applications*, Newton Institute, Cambridge, UK
- July *Mathematics of Many-Particle Systems* (conference in honor of Elliott H. Lieb, on the occasion of his 80th birthday), Berlin, Germany
- July *6th European Mathematical Congress (EMS Prize talk)*, Kraków, Poland
- May Workshop on *Mathematical and Numerical Analysis of Electronic Structure Models*, Beijing, China
- May Workshop on *Quantum Many-Body Systems*, Montréal, Canada
- Apr. *Spectral Days*, Munich, Germany
- 2011** Oct. *EMS Week End*, session on *PDEs and applications to mechanics and physics*, Bilbao, Spain
- July 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
- July Conference *Intellectual Challenges in Multiscale Modelling of Solids*, University of Oxford, UK
- June Workshop *Mathematical Methods in Quantum Chemistry*, Oberwolfach, Germany
- Feb. 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
- Aug. ICM 2010 Satellite Conference on *Quantum Systems*, Chennai, India
- June Workshop on *Matter and Radiation*, Erwin Schrödinger Institute, Vienna, Austria
- May *SIAM Conference on Mathematical Aspects of Material Sciences*, Session on *Electronic structure*, Philadelphia, USA
- Apr. *2010 British Mathematical Colloquium and British Applied Mathematics Colloquium*, Session *Spectral Theory*, Edinburgh, Scotland
- Mar. *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
- July *XI Encuentro de Matematica y sus Aplicaciones (plenary speaker)*, Quito, Ecuador
- June *Canadian-French Conference*, Montréal, Canada
- 2007** Sept. *QMATH 10*, Moeiciu, Romania
- Aug. 4th Danish Symposium on *Applied Analysis*, Copenhagen, Denmark
- July *International Conference on Scientific Computation and Differential Equations (SciCADE 2007)*. Symposium *Applications to Chemistry*, Saint-Malo, France
- Mar. *Relativistic Effects in Heavy Elements*, Ottrott, France
- Feb. Workshop *Multiscale and Variational Methods in Material Science and Quantum Theory of Solids*, Oberwolfach, Germany
- Jan. Conference *Semi-classical Days XIV*, CIRM, Marseille, France

- 2006** Oct. Conference *Mathematical and Numerical Aspects of Quantum Chemistry Problems*, Oberwolfach, Germany  
 July Conference *Mathematics in Chemistry*, Lisbon, Portugal  
 June Workshop on *Quantum Mechanics of Complex Systems*, Erwin Schrödinger Institute, Vienna, Austria
- 2005** Dec. Conference *Topological and Variational Methods in Partial Differential Equations*, Guanajuato, Mexico  
 Nov. Conference *Mathematical Methods for Ab Initio Quantum Chemistry*, Nice, France  
 Apr. Fourth international conference on *Analysis and Quantum*, München, Germany
- 2004** Dec. Conference of the 2004-2005 Warwick EPSRC Symposium on *Mathematical challenges in quantum chemistry*, Warwick, UK  
 Aug. Conference of the 2004-2005 Warwick EPSRC Symposium on *Large many-body systems*, Warwick, UK  
 July Satellite conference of the 4th European Congress of Mathematics (ECM), *Spectrum and Quantum Mechanics*, Stockholm, Sweden  
 June Workshop on *Calculus of variations*, Oberwolfach, Germany
- 2003** Dec. Meeting of the EU network “Analysis and Quantum”, ESI, Vienna, Austria  
 Feb. *Applied Mathematics and Applications of Mathematics (AMAM)*, Symposium of *Quantum Chemistry*, Nice, France