Mathieu LEWIN

CEREMADE
Université Paris-Dauphine
Place de Lattre de Tassigny
F-75 016 PARIS

Tel. (+33) 1 44 05 42 83
mathieu.lewin@math.cnrs.fr
http://www.ceremade.dauphine.fr/∼lewin

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 Polyechnique, 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

2022	Invited speaker at the International Congress of Mathematics (ICM 2022)
2017 – 2023	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

2023 – Editor for *Journal of Spectral Theory*

2022 – Chief editor (with Anne-Laure Dalibard) for the *Annales de l'Institut Henri Poincaré C – Analyse Non Linéaire*

2019 – Editor for *Probability and Mathematical Physics*

2014 – Editor for *Letters in Mathematical Physics*

2013 – Editor for *Mathematical Models and Methods in Applied Sciences (M3AS)*

Duties

2023 –	Head of the CEREMADE
2015-20, 2024–26	Elected member of the Executive Committee of the International Association of Mathematical Physics (IAMP)
2020 –	Member of the scientific committee of the labex CEMPI at Lille
2019 – 2022	Member of the research ethics committee of the university Paris-Dauphine
2015 – 2021	Elected member of the Administration Council of the French Association of Applied and Industrial Mathematics (SMAI)
Oct. 2014 – Dec. 2017	Scientific Manager for Interdisciplinarity at the CNRS Institute of Mathematics
2010 – 2014	Elected member of the Administration Council of the *Institut Henri Poincaré*

Committees & other duties

2018	Head of the committee for the IAMP Early Career Award
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 – 2023	PI of the ERC Consolidator Grant *Mathematics of Density Functional Theory*, H2020 no. 725528.
2018 – 2022	Local head of the ANR project *molQED* (molecular Quantum Electrodynamics) in chemistry
2010 – 2015	PI of the ERC Strarting 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

Michal Jex, Sept. 2020 – Aug. 2022
Peter Madsen, Oct. 2019 – Feb. 2023
Fabio Pizzichillo, Oct. 2018 – Oct. 2021
Thomas Ourmières-Bonafos, Sept. 2018 – Aug. 2019
Luca Nenna, Sept. 2017 – Aug. 2018
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

Martin Malvy, with Laure Dumaz, Sept. 2022–
Rodrigue Lelotte, Sept. 2020 –Sept. 2023
Jean Cazalis, Sept. 2018 – Aug. 2022
Louis Garrigue, Sept. 2017 – Sept. 2020
Arnaud Triay-Alcouffe, Sept. 2015 – June 2019
Raphaël Ducatez, Sept. 2015 – Aug. 2018
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 Detzen, 2024 (master Dauphine)
Maher Billon, 2024 (ENS)
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)

Recent Teaching Activities

Courses

2016 –	Various courses in Analysis, École Polytechnique
2007 –	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

Aug. 2023	*Statistical mechanics of Coulomb and Riesz gases* (4h), *VIASM-IAMP Summer-school in Mathematical Physics*, Quy Nhon, Vietnam
Mar. 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. Can be watched on `youtube`
Aug. 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
May 2022	*The mathematical description of solids* (9h), Mini-school on mathematics for theoretical chemistry and physics, GDR *NBODY*, Paris, France
Feb. 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. Can be watched on `youtube`
Apr. 2021	Mini-course on *Riesz and Coulomb gases: what's known and unknown* (2h), Online seminar of the GDR MEGA. Can be watched on `youtube`
Mar. 2019	*Nonlinear Gibbs measures and their derivation from quantum mechanics* (6h), Mittag-Leffler Institute, Stockholm, Sweden
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* (8h), 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

Dec. 2022	(with S. Serfaty), conference on *Coulomb gases and universality*, Sorbonne Université, Paris, France
12 – 16 Aug. 2019	(with J. Yngvason), session on *many-body systems*, Conference QMATH 14, Århus, Denmark
20 – 25 May 2019	Workshop on *Mean-field and other effective models in mathematical physics*, Fondation Les Treilles, France
28 Jan. – 1 Feb. 2019	(with P. Gori Giorgi & B. Pass), Conference on *Optimal Transport Methods in Density Functional Theory*, Banff International Research Station, Canada
10 Sept. – 14 Sept. 2018	(with R. L. Frank & B. Schlein), Conference on *Many-body Quantum Mechanics*, CRM Montréal, Canada
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

2020 – Member of the scientific committee for the *One World IAMP Mathematical Physics online Seminar*

2014 – Co-organizer of the monthly seminar on "Spectral Problems" of the GDR Quantum Dynamics, Institut Henri Poincaré

2017 – 2020 Co-organizer of the working group in Analysis and Probability, with Laure Dumaz

2005 – 2014 Co-organizer of the Mathematical Physics seminar, Université de Cergy-Pontoise

Outreach activities

2022 Interview by CNRS on the occasion of the ICM 2022, `website`

2021 Video interview for the website "Parlons Maths" (in French), `youtube`

2019 Video interview about the Dirac equation at ICIAM 2019, `youtube`

2019 Interview about the crystallization conjecture in *Sciences et Avenir*, no. 874

2017 M. Lewin, Bretzels, bagels, donuts et... topologie, CNRS Le Journal, `website`

2015 Portrait in *La Recherche*, `website`

2014 M. Lewin, Des cristaux et des maths, CNRS Le Journal, `website`

2014 Member of a communication team at CNRS about the year of cristallography

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`

PUBLICATIONS

Books

[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.

Published or Accepted Articles

[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.

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[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.

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[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.

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[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.

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[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.

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[55] 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.

[56] 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.

[57] 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.

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[61] 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.

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[63] 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.

[64] 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.

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Book Chapters

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Proceedings

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General Audience Articles

[1] M. Lewin. L'équation de Schrödinger pour les atomes et les molécules. *Gazette des Mathématiciens*, 177: 9–24, July 2023. Société Mathématique de France.

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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. 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.

TALKS

International Conferences (selection)

2023	Oct.	Mini-workshop on *Mathematics of Many-body Fermionic Systems*, Oberwolfach, Germany
	Sept.	Workshop on *Many-Body Quantum Systems*, Oberwolfach, Germany
	Aug.	VIASM-IAMP *summer school and workshop in Mathematical Physics*, Quy Nhon, Vietnam
	June	Conference *Frontiers in Mathematical Physics*, CY University, Cergy-Pontoise, France
	June	Conference *Correlations in Mathematical Quantum Mechanics* in honor of Jan Philip Solovej, Copenhagen, Denmark
	June	Colloquium du laboratoire de physique, ENS Lyon, France
	May	Colloquium of the Mathematical Institute, LMU Munich, Germany
	Mar.	*Maxwell Institute Mini-symposium in Analysis and PDEs*, Edinburgh, UK
	Mar.	Long course at the Conference on *Optimal Transport Theory and Applications to Physics*, Les Houches, France
2022	Aug.	Long course at the Conference on *The Statistical Physics of Continuum Particle Systems with Strong Interactions*, Singapore
	July	Conference *Advances in Mathematical Physics* in honor of Elliott H. Lieb on his 90th Birthday, Harvard, USA
	July	**Invited speaker** at the online ICM 2022. Can be watched on `youtube`
	May	Conference on *Mathematical results of many-body quantum systems*, Herrsching, Germany
	Apr.	Online talk at the workshop on *Model Reduction in Quantum Mechanics*, IPAM, University of California Los Angeles, USA
	Mar.	Conference *CY Days in Nonlinear Analysis*, Cergy-Pontoise, France
2021	Nov.	Workshop *Inverse Problems and related fields*, Marseille, France
	Aug.	Conference *Solid Math*, Marne La Vallée, France
	June	IAMP One World Mathematical Physics Seminar, online. Can be watched on `youtube`
	June	SwissMAP workshop on *Emergent theories for wave turbulence and particle dynamics*, Les Diablerets, Switzerland
	May	Conference on *Schrödinger equations*, Le Croisic, France
	Apr.	Eighth Texas Analysis and Mathematical Physics Symposium, online conference at UT Austin, USA
2020	Jan.	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
	July	Minisymposia on *Dirac Hamiltonians with critical singularities*, ICIAM Conference, Valencia, Spain
	June	Conference on *Mathematical and Numerical Analysis of Electronic Structure Models*, Suzhou, China
	Jan.	Kick-off conference of the trimester on *Spectral Methods in Mathematical Physics*, Mittag-Leffler Institute, Stockholm, Sweden
2018	Dec.	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
	July	Conference on *Physics and Mathematics of Quantum Field Theory*, Banff International Research Station, Canada
	July	*International Congress on Mathematical Physics* (contributed talk), Montréal, Canada
	July	Colloquium of the Mathematics Department, LMU Munich, Germany

	June	SIAM Conference on *Nonlinear Waves*, Los Angeles, USA
	June	Workshop on *The analysis of Dirac equations*, Orsay, France
	May	Conference on *Partial Differential Equations in Physics and Materials Science*, Heraklion, Crete
	May	Conference on *Recent Results on Quantum Many-Body Systems* (in honor of Heinz Siedentop), Herrsching, Germany
	Mar.	Workshop on *Mathematical Methods in Quantum Chemistry*, Oberwolfach, Germany
2017	Sept.	Workshop on *Quantum Field Theory*, Oberwolfach, Germany
	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 Insitute 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 *Supraconductivity, 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)**, Krakòw, 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*. Bressanone, Italy
2010	Sept.	Conference on *New Approaches in Many-Electron Theory*, Max-Plank-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
	Aug.	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
	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*, Münich, 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