

CURRICULUM VITAE, PROFESSOR TERRY A. LORING

Distinguished Professor
Department of Mathematics and Statistics,
University of New Mexico,
Albuquerque, NM 87131,
U.S.A.

Education

Wesleyan University, Connecticut, B.A., Mathematics, 1981.

University of California, Berkeley, Ph.D., Mathematics, 1986.

Employment

Mathematical Sciences Research Institute, Research Fellow, Berkeley, California, 1986 to 1987.

Swansea University, Research Fellow, U.K. 1987.

Dalhousie University, Killam Postdoctoral Fellow, Halifax, Canada (partially supported by NSERC), 1988 to 1990.

National Science Foundation, Postdoctoral Fellow, University of New Mexico, Albuquerque, 1990 to 1993.

University of New Mexico, Assistant Professor, Albuquerque, 1990 to 1993.

University of New Mexico, Associate Professor, Albuquerque, 1993 to 1999.

University of New Mexico, Professor, Albuquerque, since 1999.

University of New Mexico, Department Chair, Mathematics and Statistics, Albuquerque, August 2011 to August 2016.

University of New Mexico, Distinguished Professor, Albuquerque, since 2020.

Affiliations

Fields Institute for Research in Mathematical Science, Visiting Member, Toronto, Canada, 1995 to 1996.

Center for Advanced Research Computing, University of New Mexico, Faculty Associate, since August 2002.

Center for Integrated Nanotechnologies, Sandia National Laboratories, Albuquerque NM, Approved User, since 2021.

Honors

Member, **Phi Beta Kappa**, since 1981.

Fellow, **American Mathematical Society**, since 2020.

Funding

“U.S.-Brazil Cooperative Research: Operator Algebras,” co-P.I. with Ruy Exel, **National Science Foundation**, 7/91–2/94, \$8,342.

“Lifting and Perturbation Problems in C^* -Algebras,” co-P.I. with Gert K. Pedersen, **NATO-International Scientific Exchange Programs**, 3/92–2/93, \$7,000.

“Operator Algebras,” co-P.I. with Frank Gilfeather, **National Science Foundation**, included Research Opportunity Award for Belisario Ventura, 1/93–6/96, \$107,391.

“Classification of C^* -algebras,” co-applicant in Collaborative Project Grant, led by George Elliott, funded by the **NSERC of Canada**, \$250,000 (CND), 94–96. This grant went to the University of Toronto to fund a thematic program at the Fields Institute.

Co-P.I., **Department of the Army** grant, with Ricardo Maestas, “Minority Engineering, Mathematics, and Science Program,” 1995–6, \$780,000.

“Stable Relations and Their Loci in Operator Variables.” **National Science Foundation**, 4/96–5/99, \$89,900.

“Stable Relations and Their Loci in Operator Variables.” **National Science Foundation**, 8/99–6/02, \$67,682.

“The New Mexico Bioscience Center for Informatics” co-P.I. with Terry Yates et al., **DARPA**, 2/02–12/03, \$1,430,000.

“Predictive Modeling, Visualization and Data Reduction,” co-P.I. with Frank Gilfeather, **DARPA**, 6/03–5/06, \$70,331.

“West Coast Operator Algebra Seminar,” **National Science Foundation**, 2011–2012, \$25,550.

“Structured Operator Algebras for Physics,” collaborative research grant, **Simons Foundation**, 2011–2016, \$35,000.

“Operator algebras and topological insulators,” collaborative research grant, **Simons Foundation**, 2016–2017, \$7,000.

“Emergent Topology and K -Theory of Matrix Models,” **National Science Foundation**, 2017–2020, \$183,658.

“Numerical Methods in Noncommutative Matrix Analysis,” **National Science Foundation**, 2021–2024, \$119,972.

“Quantifying stability of corner states in topological insulators,” subcontract from **Sandia National Laboratories**, 2021–2022, \$89,708.

“CINT Summer Research Initiative,” subcontract from **Sandia National Laboratories**, 2022, \$13,201.

“Identifying and classifying localized states in gapless systems using pseudospectral methods,” subcontract from **Sandia National Laboratories**, October 2022–September 2025, \$129,947. Sole PI.

“Expanding K -theory for real space invariants,” subcontract from **Sandia National Laboratories**, November 2023–September 2026, \$261,000.

TEACHING

Graduate Teaching

Courses Taught

Measure Theory, Functional Analysis, Introduction to C^* -Algebras, Noncommutative Ring Theory, Seminar in Operator Algebras, Seminar in Analysis, Algebra, Real Analysis, Topology, Algebraic Topology.

Supervision and Mentorship

Søren Eilers, visiting graduate student scholar at UNM in 1994. PhD completed at the University of Copenhagen.

Martha Monteiro, Ph.D., completed September 2000.

Tony Malerich, M.A., completed May 2002.

David Worth, M.A., completed December 2006.

Adam Sørensen, visiting graduate student scholar at UNM, Fall 2010. PhD completed at the University of Copenhagen.

Andrea Schmidt, M.A., complete December 2012.

Fredy Vides, Ph.D., completed May 2016.

Undergraduate Teaching

Mathematics Courses Taught

Calculus, Linear Algebra, Graph Theory, Abstract Algebra, Discrete Structures, Advanced Calculus, Introduction to Topology, Fourier Analysis and Wavelets, Complex Analysis.

Supervision and Mentorship

Patrick H. DeBonis, honors dissertation, 2019.

Dominic Cordova, REU project, 2021–2022.

Other

“Introduction to Computers,” taught for the summer bridge program of the UNM Minority Engineering, Mathematics and Sciences Program, 1995.

Nominated for UNM Teacher of the Year, 1997.

Corresponding secretary and faculty advisor to the New Mexico Alpha chapter of Kappa Mu Epsilon, August 2002 to August 2003.

Ronald E. McNair Scholars Program, August 2003 to August 2004, supervised research of Belin M. Tsinnajinnie, “An Interactive Approach to Computer Detection of Neurological Signals.”

“Teachers, Majors, Data Structures Takers: Learning proofs in a very mixed class,” San Diego AMS/MAA meeting, Special Session on *Crossing the Bridge to Higher Mathematics*, January 2008.

SERVICE

Department Service

graduate committee.

undergraduate committee.

computer use committee.

hiring committees.

various PhD dissertation committees in mathematics.

scheduling committee.

department chair, 2011–2016.

University Service

Faculty Senator from Arts and Science, Fall 2001 to Spring 2003 and Fall 2004 to Spring 2005.

Chair of the UNM Faculty Intellectual Property Committee, Fall 2001.

Member of the UNM Computer Use Committee, 2003/4.

External Examiner for a PhD defense, University of New Mexico, Physics Department, June 2012.

External Examiner for a PhD defense, University of New Mexico, Physics Department, December 2012.

Member, UNM STEM-Gateway Course Reform Council, 2013–2015.

Member, UNM Educator Preparation Council, 2016–2017.

External Examiner for a PhD defense, University of New Mexico, Physics Department, December 2018.

Conference organizing

Organizer of a workshop on Operator algebras, June 7–11, 1993, University of New Mexico, Albuquerque.

Organizer of a special session, “Almost Multiplicative Maps, C^* -algebras and Deformations,” American Mathematical Society meeting, January 4-7, 1995, San Francisco, California.

Chair of the scientific committee for a 1996 Joint Summer Research Conference, “Classification Problems in C^* -algebras and Dynamical Systems,” Mount Holyoke College, South Hadley, Massachusetts.

Organizer of the workshop “Semiprojectivity and asymptotic morphisms,” University of Copenhagen, May 2010 (with Eilers and Shulman).

Organizer of a special session, “Positivity in Noncommutative Settings,” meeting of the American Mathematical Society, April 17–18, 2010, Albuquerque, New Mexico.

Organizer of the West Coast Operator Algebra Seminar, October 1-2, 2011, University of New Mexico.

Organizer of the workshop “Semiprojectivity,” University of Copenhagen, September 2012 (with Eilers).

Scientific committee of the West Coast Operator Algebra Seminar, October 26-27, 2013, University of California at Davis.

Other

Member of the Centennial Fellowships Selection Committee of the American Mathematical Society, 1995.

External Examiner for a PhD defense, University of Toronto, August 2009.

Member of funding jury for the French National Research Agency (ANR), 2010–2011.

Editorial board member of the *Annals of Functional Analysis*, 2011–2014.

Member of funding jury for the French National Research Agency (ANR), 2015.

On-site Reviewer of a multi-university physics center, on behalf of the Deutsche Forschungsgemeinschaft (DFG), 2016.

Member of funding jury for the French National Research Agency (ANR), 2018.

RESEARCH

Supervision

Robert Niemeyer, postdoctoral fellow in the Mentoring through Critical Transition Points (MCTP) program, 2012–2015.

Conference and Colloquium Talks

Operator Algebras Conference, Santa Barbara, 1986.

Symposium on Operator Theory, Cork, Ireland, 1987.

US-UK Joint Seminar on Operator Algebras, Warwick, England, 1987.

Workshop on Operator Algebras, Oberwolfach, Germany, 1987.

London Mathematical Society, Spitalfield Lecture, Warwick, England, 1987.

North British Functional Analysis Seminar, Glasgow, Scotland, 1987.

American Mathematical Society Summer Research Institute in Operator Algebras, Durham, New Hampshire, 1988.

Canadian Operator Theory Symposium, London, Canada, 1988.

Special Session on Operator Algebras and Geometry, American Mathematical Society annual meeting, Phoenix, 1989.

Canadian Operator Symposium, Toronto, Canada, 1989.

Special Session on Reduction of Real Rank in C^* -algebras, American Mathematical Society annual meeting, San Francisco, 1991.

Canadian Operator Theory Symposium, Montreal, Canada, 1991.

Special Session on C^* -algebras and Algebraic Topology, American Mathematical Society meeting, Springfield, Missouri, 1992.

Great Plains Operator Theory Symposium, Iowa City, Iowa, 1992.

Invariants in Operator Algebra, a commemorative symposium of the Royal Danish Academy of Sciences and Letters, Copenhagen, Denmark, 1992.

Great Plains Operator Theory Symposium, Boulder, Colorado 1993.

Canadian Operator Theory Symposium, Victoria, Canada, 1993.

Special Session on Noncommutative Differential Geometry, American Mathematical Society meeting, College Station, Texas, 1993.

Special Session on C^* -Algebras and von Neumann Algebras, American Mathematical Society meeting, Cincinnati, Ohio, 1994.

Conference on C^* -algebras, Oberwolfach, Germany, 1994.

West Coast Operator Algebra Seminar, Los Angeles, 1994.

Workshop on The Classification of Amenable C^* -algebras, the Fields Institute, Toronto, Canada, 1994.

Conference on C^* -algebras, Oberwolfach, Germany, 1996.

Great Plains Operator Theory Seminar, Tempe, 1996.

Special Session on C^* -algebras, American Mathematical Society meeting, San Diego, January, 1997.

Special Session on C^* -algebras, American Mathematical Society meeting, Corvallis, Oregon, April, 1997.

Canadian Operator Theory Symposium, Kingston, Canada, May 1997.

New Mexico Analysis Seminar, Las Cruces, New Mexico, February 2000.

Symposium in Honor of Gert Pedersen on the Occasion of his 60th Birthday, The Carlsberg Academy, Copenhagen, Denmark, May 1-4, 2000.

IEEE Society of Albuquerque, monthly meeting, Albuquerque, February 2003.

The Society for Neuroscience Annual Meeting (poster session), New Orleans, November 2003.

Third International Conference on Machine Learning and Cybernetics, Shanghai, China, August 2004.

Great Plains Operator Theory Symposium, Lincoln, Nebraska, 2007.

New Mexico Analysis Seminar, October, 2007.

American Mathematical Society meeting, Special Session on E -Theory, Extensions, and Elliptic Operators, San Diego, January 2008.

Fifth Øresund Symposium on Non-Commutative Analysis and Non-Commutative Geometry, Copenhagen, Denmark, April 2008.

West Coast Operator Algebra Seminar, Flagstaff, Arizona, "Amalgamated products and extensions of C^* -algebras," September 2008.

Great Plains Operator Theory Symposium, Boulder, Colorado, June 2009.

Multivariate Operator Theory Workshop, the Fields Institute, Toronto, Canada, August 2009.

Semiprojectivity and asymptotic morphisms workshop, University of Copenhagen, May 2010.

Great Plains Operator Theory Symposium, Denver, Colorado, June 2010.

West Coast Operator Algebra Seminar, Pachuca, Mexico, September 2010.

Nebraska-Iowa Functional Analysis Seminar, Omaha, Nebraska, November 2010.

Challenges in Aperiodic Media, "The real K -theory of topologically protected phases in condensed matter," Lyon, France, February 2011.

Great Plains Operator Theory Symposium, Tempe, Arizona, “Weak semiprojectivity and five related properties for C^* -algebras,” May 2011.

Canadian Mathematical Society meeting, Special Session on *Operator Algebras*, “Topological insulators and real almost commuting matrices,” Edmonton, Canada June 2011.

Workshop on Noncommutative Geometry, “ KO invariants and topological insulators,” Mathematisches Forschungsinstitut Oberwolfach, Oberwolfach Germany, September 2011.

Great Plains Operator Theory Symposium, Houston, Texas, “Almost commuting Hermitian matrices over the real, complex or quaternionic numbers,” June 2012.

Workshop on Semiprojectivity of C^* -algebras, “Anti-unitary symmetries, from physics to almost commuting matrices,” Copenhagen, Denmark, September 2012.

Banff International Research Station for Mathematical Innovation and Discovery, workshop Topological Phenomena in Quantum Dynamics and Disordered Systems, “ K -theory invariants for almost commuting matrices,” Alberta Canada, February 2013.

Journées de Physique Mathématique Lyon, “ K -theory, localization and generalized Wannier functions,” Lyon France, September 2013.

American Mathematical Society meeting, Special Session on Progress in Noncommutative Analysis, “Numerical Experiments on the Modulus of Continuity of Matrix Functions,” Albuquerque NM, April 2014.

Workshop on C^* -Algebras and Dynamical Systems, the Fields Institute, “Homotopy classification of free-particle, gapped, finite systems,” Toronto, Canada, June 2014.

Programme on Topological Phases of Quantum Matter, the Schrödinger Institute for Mathematical Physics, “Joint pseudospectra and the K -theory of local energy gaps,” Vienna, Austria, August 2014.

CBMS meeting on the Basic Homotopy Lemma, Asymptotic Uniqueness Theorem and the Classification of C^* -Algebras, “Approximately compatible observables and K -theory,” Wyoming, June 2015.

Conference on Noncommutative index theory, “Emergent topology of insulators,” the Banach Center, Warsaw, Poland, October 2016.

Mathematical and Physical Aspects of Topologically Protected States, a KI-Net conference, “ K -theory via the emergent topology of insulators,” New York, May 2017.

Great Plains Operator Theory Symposium, Fort Worth, Texas, “Multivariate Pseudospectrum and K -theory,” May 2017.

Satellite Conference on Operator Algebras (MCA2017), “Multivariate pseudospectrum and almost commuting Hermitian matrices,” Toronto, August 2017.

Photonic Topological Insulators, workshop, “Local indices and quantified topological protection,” at the Banff International Research Station, Banff Canada, September 2017.

Topological Dynamics: Quantum and Classical, workshop at the New Jersey Institute of Technology, “Quantifying topological protection via local K-theory,” November 2107.

Great Plains Operator Theory Symposium, College Station, Texas, “Computable formulas for the connecting maps in real or graded K-theory,” May 2019.

Topological Phases of Interacting Quantum Systems, workshop at Casa Matemática Oaxaca, Mexico, “The spectral localizer for estimating bulk gaps and calculating K-theory,” June 2019.

American Mathematical Society meeting, special session Quantum Theory of Matter Meets Noncommutative Geometry and Topology, “A numerical approach to Chern numbers and unbounded Fredholm modules,” Denver Colorado, January 2020.

Mathematical Physics Seminar, Princeton University, “Emergent Topology From Finite Volume Topological Insulators,” October 2021.

Below, the symbol \bullet indicates an original research article published or accepted by a refereed journal or conference proceedings, \circ indicates expository writing, and \otimes indicate something only posted on a preprint server.

PUBLICATIONS

- [1] \bullet Terry A. Loring. K -theory and asymptotically commuting matrices. *Canad. J. Math.*, 40(1):197–216, 1988.
- [2] \bullet Ruy Exel and Terry Loring. Almost commuting unitary matrices. *Proc. Amer. Math. Soc.*, 106(4):913–915, 1989.
- [3] \bullet Terry A. Loring. The noncommutative topology of one-dimensional spaces. *Pacific J. Math.*, 136(1):145–158, 1989.
- [4] \bullet Peter Borwein and Terry A. Loring. Some questions of Erdős and Graham on numbers of the form $\sum g_n/2^n$. *Math. Comp.*, 54(189):377–394, 1990.
- [5] \bullet Terry A. Loring. The K -theory of AF embeddings of the rational rotation algebras. *K-Theory*, 4(3):227–243, 1991.
- [6] \bullet Ruy Exel and Terry A. Loring. Invariants of almost commuting unitaries. *J. Funct. Anal.*, 95(2):364–376, 1991.
- [7] \bullet Terry A. Loring. Berg’s technique for pseudo-actions with applications to AF embeddings. *Canad. J. Math.*, 43(1):119–157, 1991.
- [8] \bullet George A. Elliott, Ruy Exel, and Terry A. Loring. The soft torus. III. The flip. *J. Operator Theory*, 26(2):333–344, 1991.
- [9] \bullet Ruy Exel and Terry A. Loring. Finite-dimensional representations of free product C^* -algebras. *Internat. J. Math.*, 3(4):469–476, 1992.
- [10] \bullet Marius Dadarlat and Terry A. Loring. The K -theory of abelian subalgebras of AF algebras. *J. Reine Angew. Math.*, 432:39–55, 1992.
- [11] \bullet George A. Elliott and Terry A. Loring. AF embeddings of $C(\mathbf{T}^2)$ with a prescribed K -theory. *J. Funct. Anal.*, 103(1):1–25, 1992.
- [12] \bullet Ruy Exel and Terry A. Loring. Extending cellular cohomology to C^* -algebras. *Trans. Amer. Math. Soc.*, 329(1):141–160, 1992.
- [13] \bullet Terry A. Loring. Projective C^* -algebras. *Math. Scand.*, 73(2):274–280, 1993.

- [14] •Terry A. Loring. C^* -algebras generated by stable relations. *J. Funct. Anal.*, 112(1):159–203, 1993.
- [15] •Terry A. Loring. Deformations of nonorientable surfaces as torsion E -theory elements. *C. R. Acad. Sci. Paris Sér. I Math.*, 316(4):341–346, 1993.
- [16] •Marius Dadarlat and Terry A. Loring. Extensions of certain real rank zero C^* -algebras. *Ann. Inst. Fourier (Grenoble)*, 44(3):907–925, 1994.
- [17] •Terry A. Loring and Jack Spielberg. Approximation of normal elements in the multiplier algebra of an AF C^* -algebra. *Proc. Amer. Math. Soc.*, 121(4):1173–1175, 1994.
- [18] •Marius Dadarlat and Terry A. Loring. K -homology, asymptotic representations, and unsuspending E -theory. *J. Funct. Anal.*, 126(2):367–383, 1994.
- [19] •Marius Dadarlat and Terry A. Loring. Deformations of topological spaces predicted by E -theory. In *Algebraic methods in operator theory*, pages 316–327. Birkhäuser Boston, Boston, MA, 1994.
- [20] •Terry A. Loring. A test for injectivity for asymptotic morphisms. In *Algebraic methods in operator theory*, pages 272–275. Birkhäuser Boston, Boston, MA, 1994.
- [21] •Terry A. Loring. Normal elements of C^* -algebras of real rank zero without finite-spectrum approximants. *J. London Math. Soc. (2)*, 51(2):353–364, 1995.
- [22] •Marius Dadarlat and Terry A. Loring. A universal multicoefficient theorem for the Kasparov groups. *Duke Math. J.*, 84(2):355–377, 1996.
- [23] •Marius Dadarlat and Terry A. Loring. Classifying C^* -algebras via ordered, mod- p K -theory. *Math. Ann.*, 305(4):601–616, 1996.
- [24] •Terry A. Loring. Stable relations. II. Corona semiprojectivity and dimension-drop C^* -algebras. *Pacific J. Math.*, 172(2):461–475, 1996.
- [25] •Terry A. Loring. Perturbation questions in the Cuntz picture of K -theory. *K-Theory*, 11(2):161–193, 1997.
- [26] •Don Hadwin and Terry A. Loring. Normal operators in C^* -algebras without nice approximants. *Proc. Amer. Math. Soc.*, 125(1):159–161, 1997.
- [27] •Terry A. Loring and Gert K. Pedersen. Corona extendibility and asymptotic multiplicativity. *K-Theory*, 11(1):83–102, 1997.
- [28] •Terry A. Loring and Gert K. Pedersen. Smoothing techniques in C^* -algebra theory. *J. Operator Theory*, 37(1):3–21, 1997.
- [29] ◦Terry A. Loring. *Lifting solutions to perturbing problems in C^* -algebras*, Volume 8 of Fields Institute Monographs. American Mathematical Society, Providence, RI, 1997.
- [30] •Terry A. Loring. Almost multiplicative maps between C^* -algebras. In *Operator algebras and quantum field theory (Rome, 1996)*, pages 111–122. Int. Press, Cambridge, MA, 1997.
- [31] •Terry A. Loring. When matrices commute. *Math. Scand.*, 82(2):305–319, 1998.
- [32] •Søren Eilers, Terry A. Loring, and Gert K. Pedersen. Quasidiagonal extensions and AF algebras. *Math. Ann.*, 311(2):233–249, 1998.
- [33] •Terry A. Loring. C^* -algebras that are only weakly semiprojective. *Proc. Amer. Math. Soc.*, 126(9):2713–2715, 1998.
- [34] •Terry A. Loring and Gert K. Pedersen. Projectivity, transitivity and AF-telescopes. *Trans. Amer. Math. Soc.*, 350(11):4313–4339, 1998.
- [35] •Søren Eilers, Terry A. Loring, and Gert K. Pedersen. Stability of anticommutation relations: an application of noncommutative CW complexes. *J. Reine Angew. Math.*, 499:101–143, 1998.

- [36] •Søren Eilers, Terry A. Loring, and Gert K. Pedersen. Fragility of subhomogeneous C^* -algebras with one-dimensional spectrum. *Bull. London Math. Soc.*, 31(3):337–344, 1999.
- [37] •Søren Eilers, Terry A. Loring, and Gert K. Pedersen. Morphisms of extensions of C^* -algebras: pushing forward the Busby invariant. *Adv. Math.*, 147(1):74–109, 1999.
- [38] •Søren Eilers and Terry A. Loring. Computing contingencies for stable relations. *Internat. J. Math.*, 10(3):301–326, 1999.
- [39] •Terry A. Loring, David E. Worth, and Akaysha C. Tang. Multiresolution metrics for detecting single-trial event-related potentials (ERPs). In *Proceedings of the 3rd IEEE International Conference on Machine Learning and Cybernetics (ICMLC 2004), Shanghai, China*, 2004.
- [40] •Frank Gilfeather, et al. Learning and modeling biosignatures from tissue images. *Comput. Biol. Med.*, 37(11):1539–1552, 2007.
- [41] •Terry A. Loring. Rényi dimension and Gaussian filtering. *New York J. Math.*, 13:175–198, 2007.
- [42] •Terry A. Loring. Rényi dimension and Gaussian filtering, II. *New York J. Math.*, 14:577–599, 2008.
- [43] •Terry A. Loring. A projective C^* -algebra related to K -theory. *J. Funct. Anal.*, 254(12):3079–3092, 2008.
- [44] •Terry A. Loring. Projective C^* -algebras and boundary maps. *Münster J. of Mathematics*, 1:221–236, 2008.
- [45] •Terry A. Loring. C^* -algebra relations. *Math. Scand.*, 107:43–72, 2010.
- [46] •Matthew B. Hastings and Terry A. Loring. Almost commuting matrices, localized Wannier functions, and the quantum Hall effect. *J. Math. Phys.*, 51(1):015214, 2010.
- [47] •Terry A. Loring and Matthew B. Hastings. Disordered topological insulators via C^* -algebras. *Europhys. Lett. EPL*, 92:67004, 2010.
- [48] •Matthew B. Hastings and Terry A. Loring. Topological insulators and C^* -algebras: Theory and numerical practice. *Ann. Physics*, 326(7):1699–1759, 2011.
- [49] •Terry A. Loring and Tatiana Shulman. Noncommutative semialgebraic sets and associated lifting problems. *Trans. Amer. Math. Soc.*, 364:721–744, 2012.
- [50] •Terry A. Loring and Tatiana Shulman. A generalized spectral radius formula and Olsen’s question. *J. Funct. Anal.*, 262(2):719–731, 2012.
- [51] •Terry A. Loring. The point in weak semiprojectivity and AANR compacta. *Topology Appl.*, 159(3):850–863, 2012.
- [52] •Terry A. Loring. From matrix to operator inequalities. *Canad. Math. Bull.*, 55(2):339–350, 2012.
- [53] •Terry A. Loring. Weakly projective C^* -algebras. *Rocky Mountain J. Math.*, 42(3):959–977, 2012.
- [54] •Terry A. Loring and Tatiana Shulman. Noncommutative semialgebraic sets in nilpotent variables. *New York J. Math.*, 18:361–372, 2012.
- [55] ◦Terry A. Loring. Factorization of matrices of quaternions. *Expo. Math.*, 30(3):250–267, 2012.
- [56] •Terry A. Loring and Adam P. W. Sørensen. Almost commuting unitary matrices related to time reversal. *Comm. Math. Phys.*, 323(3):859–887, 2013.
- [57] ⊗ Michael M. Bronstein, Klaus Glashoff, and Terry A. Loring. Making Laplacians commute. arXiv:1307.6549 (2013).

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- [59] •Terry A. Loring. Computing a logarithm of a unitary matrix with general spectrum. *Numer. Linear Algebra Appl.*, 21(6):744–760, 2014.
- [60] •Terry A. Loring. Principal angles and approximation for quaternionic projections. *Ann. Funct. Anal.*, special volume dedicated to Professor Tsuyoshi Ando, 5(2):176–187, 2014.
- [61] •Terry A. Loring. Quantitative K -theory related to spin Chern numbers. *SIGMA Symmetry Integrability Geom. Methods Appl.*, 10:077, 2014.
- [62] •Terry A. Loring and Adam P. W. Sørensen. Almost Commuting Orthogonal Matrices. *J. Math. Anal. Appl.* 420(2):1051–1068, 2014.
- [63] •Terry A. Loring and Fredy Vides. Estimating norms of commutators. *Exper. Math.* 24(1):106–122, 2015.
- [64] •Terry A. Loring. K -theory and pseudospectra for topological insulators. *Ann. Physics*, 356 383–416, 2015.
- [65] •Jeffrey L. Boersema, Terry A. Loring and Efren Ruiz. Pictures of KK -theory for real C^* -algebras. *Banach J. Math. Anal.*, 10:127–47, 2016.
- [66] •Ion Cosma Fulga, Dmitry I. Pikulin and Terry A. Loring. Aperiodic Weak Topological Superconductors. *Phys. Rev. Lett.*, 116(25):257002, 2016.
- [67] •Terry A. Loring and Adam P. W. Sørensen. Almost commuting self-adjoint matrices: the real and self-dual cases, *Rev. Math. Phys.*, 28(7):1650017, 2016.
- [68] •Jeffrey L. Boersema and Terry A. Loring. K -Theory for Real C^* -algebras via Unitary Elements with Symmetries. *New York J. Math.*, 22:1139–1220, 2016.
- [69] •Terry A. Loring and Hermann Schulz-Baldes. Finite volume calculation of K -theory invariants. *New York J. Math.*, 23:1111–1140, 2017.
- [70] •Terry A. Loring and Fredy Vides. Local Matrix Homotopies and Soft Tori. *Banach J. Math. Anal.*, 1(1):167–190, 2018.
- [71] •Terry A. Loring and Hermann Schulz-Baldes. The spectral localizer for even index pairings. *J. Noncommut. Geom.*, 14:1–23, 2020.
- [72] •Terry A. Loring and Hermann Schulz-Baldes. Spectral flow argument localizing an odd index pairing., *Canad. Math. Bull.*, 10.4153/CMB-2018-013-x, 2019.
- [73] •Terry A. Loring. Bulk Spectrum and K -theory for Infinite-Area Topological Quasicrystal. *J. Math. Phys.* 60(8):081903, 2019.
- [74] ⊗Terry A. Loring. A Guide to the Bott Index and Localizer Index. Arxiv:1907.11791, 2019.
- [75] •J. Michala, A. Pierson, T. A. Loring, A. B. Watson. Wave-packet propagation in a finite topological insulator and the spectral localizer index. *Involve*, 14(2):209–239, 2021.
- [76] •Terry A. Loring and Fredy Vides. Computing Floquet Hamiltonians with Symmetries. *J. Math. Phys.* 61, 113501 (2020). (23 pages.)
- [77] ◦Terry A. Loring, Jianfeng Lu, Alexander B. Watson. Locality of the windowed local density of states. Arxiv, 2021.
- [78] •Patrick H. DeBonis, Terry A. Loring and Roman Sverdlov, Surfaces and hypersurfaces as the joint spectrum of matrices, *Rocky Mountain J. Math.*, 52(4):1319-1343, 2022.
- [79] •Alexander Cerjan, Terry A. Loring. Local invariants identify topology in metals and gapless systems. *Phys. Rev. B.* 106(6):064109 (2022).

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 - [81] • Alexander Cerjan, Terry A. Loring. An operator-based approach to topological photonics. *Nanophotonics*, 2022. DOI: 10.1515/nanoph-2022-0547.
 - [82] • Wenting Cheng, Alexander Cerjan, Ssu-Ying Chen, Emil Prodan, Terry A. Loring and Camelia Prodan. Revealing Topology in Metals using Experimental Protocols Inspired by K -Theory. *Nat. comm.* 14 (1), 3071, 2023.
 - [83] • Alexander Cerjan, Terry A. Loring and Fredy Vides. Quadratic pseudospectrum for identifying localized states. *J. Math. Phys.* 64(2):023501, 2023.
 - [84] • Kahlil Y. Dixon, Terry A. Loring and Alexander Cerjan. Classifying topology in photonic heterostructures with gapless environments. *Phys. Rev. Lett.* 130(21):213801, 2023.
 - [85] • Wong, Stephan, Terry A. Loring, and Alexander Cerjan. Probing topology in nonlinear topological materials using numerical K -theory. *Phys. Rev. B.* 108(19):195142, 2023.
 - [86] • Cerjan, Alexander and Terry A. Loring. Even spheres as joint spectra of matrix models. *J. Math. Anal. Appl.* 531(1):127892, 2024.
 - [87] • Cerjan, Alexander, Terry A. Loring and Hermann Schulz-Baldes. Local markers for crystalline topology. *Phys. Rev. Lett.* to appear.
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