Austen Lamacraft

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Relevant recent experience

Researcher with 20+ years' experience:

Current research focus in Quantum Computing and Machine Learning. Extensive knowledge of Python scientific and machine learning stack (e.g. NumPy, SciPy, Pandas, PyTorch, JAX).

Formulating and executing complex research projects involving multiple team members.

Recruitment and managing research of undergraduates, postgraduates and postdocs.

Employment

University of Cambridge

Lecturer → Reader → Professor of Theoretical Physics 2012-2023

University of Virginia

Assistant → Associate Professor 2007-2012

All Souls College, University of Oxford

Postdoctoral Fellow 2005-2007

Princeton University

Robert H. Dicke Fellow, Department of Physics 2002-2005

Trinity College, University of Cambridge

Junior Research Fellow 2001-2007

Barclays Capital, London

Interest rate derivatives quant 1998-2000

Expositions and side projects

Machine Learning and Statistical Mechanics (Lecture 1, Lecture 2)

New Rules: Quantum Circuits, Cellular Automata, Complexity and Chaos (Aspen colloquium see also YouTube)

Cambridge Computational Physics course and Maths question site

Education

Trinity College, University of Cambridge

PhD in Theoretical Physics	2002
Master of Mathematics (Distinction)	1998
MA in Natural Sciences (First class)	1997

Publications

Claeys, P. W., Lamacraft, A., & Vicary, J. (2023). From dual-unitary to biunitary: A 2-categorical model for exactly-solvable many-body quantum dynamics. *arXiv Preprint arXiv:2302.07280*.

Causer, L., Garrahan, J. P., & Lamacraft, A. (2022). Slow dynamics and large deviations in classical stochastic fredkin chains. *Physical Review E*, *106*(1), 014128.

Claeys, P. W., Henry, M., Vicary, J., & Lamacraft, A. (2022). Exact dynamics in dual-unitary quantum circuits with projective measurements. *Physical Review Research*, *4*(4), 043212.

Claeys, P. W., Herzog-Arbeitman, J., & Lamacraft, A. (2022). Correlations and commuting transfer matrices in integrable unitary circuits. *SciPost Physics*, *12*(1), 007.

Claeys, P. W., & Lamacraft, A. (2022). Dissipative dynamics in open XXZ richardson-gaudin models. *Physical Review Research*, *4*(1), 013033.

Claeys, P. W., & Lamacraft, A. (2022). Emergent quantum state designs and biunitarity in dual-unitary circuit dynamics. *Quantum*, *6*, 738.

Claeys, P. W., Lamacraft, A., & Herzog-Arbeitman, J. (2022). Absence of superdiffusion in certain random spin models. *Physical Review Letters*, *128*(24), 246603.

Gispen, W., & Lamacraft, A. (2022). Ground states of quantum many body lattice models via reinforcement learning. *Mathematical and Scientific Machine Learning*, 369–385.

Claeys, P. W., & Lamacraft, A. (2021). Ergodic and nonergodic dual-unitary quantum circuits with arbitrary local hilbert space dimension. *Physical Review Letters*, *126*(10), 100603.

Jain, M. S., Polanski, K., Conde, C. D., Chen, X., Park, J., Mamanova, L., Knights, A., Botting, R. A., Stephenson, E., Haniffa, M., et al. (2021). MultiMAP: Dimensionality reduction and integration of multimodal data. *Genome Biology*, *22*(1), 1–26.

Vargas, F., Thodoroff, P., Lamacraft, A., & Lawrence, N. (2021). Solving schrödinger bridges via maximum likelihood. *Entropy*, *23*(9). https://doi.org/10.3390/e23091134

Barr, A., Gispen, W., & Lamacraft, A. (2020). Quantum ground states from reinforcement learning. *Mathematical and Scientific Machine Learning*, 635–653.

Claeys, P. W., & Lamacraft, A. (2020). Maximum velocity quantum circuits. *Physical Review Research*, *2*(3), 033032.

Gispen, W., & Lamacraft, A. (2020). Ground states of quantum many body lattice models via reinforcement learning. *arXiv Preprint arXiv:2012.07063*.

Friedman, A. J., Vasseur, R., Lamacraft, A., & Parameswaran, S. A. (2019). Quantum brownian motion in a quasiperiodic potential. *Phys. Rev. B*, *100*, 060301. https://doi.org/10.1103/PhysRevB.100.060301

Gopalakrishnan, S., & Lamacraft, A. (2019). Unitary circuits of finite depth and infinite width from quantum channels. *Phys. Rev. B*, *100*, 064309. https://doi.org/10.1103/PhysRevB.100.064309

Bondesan, R., & Lamacraft, A. (2019). Learning symmetries of classical integrable systems. In *arXiv preprint arXiv:1906.04645*.

Uranga, B. M., & Lamacraft, A. (2019). SchrödingeRNN: Generative modeling of raw audio as a continuously observed quantum state. *arXiv Preprint arXiv:1911.11879*.

Rowlands, D. A., & Lamacraft, A. (2018). Noisy coupled qubits: Operator spreading and the fredrickson-andersen model. *Phys. Rev. B*, *98*, 195125. https://doi.org/10.1103/PhysRevB.98.195125

Oakes, T., Powell, S., Castelnovo, C., Lamacraft, A., & Garrahan, J. P. (2018). Phases of quantum dimers from ensembles of classical stochastic trajectories. *Phys. Rev. B*, *98*, 064302. https://doi.org/10.1103/PhysRevB.98.064302

Mencia Uranga, B., & Lamacraft, A. (2018). Infinite lattices of vortex molecules in rabi-coupled condensates. *Phys. Rev. A*, *97*, 043609. https://doi.org/10.1103/PhysRevA.97.043609

Rowlands, D. A., & Lamacraft, A. (2018). Noisy spins and the richardson-gaudin model. *Phys. Rev. Lett.*, *120*, 090401. https://doi.org/10.1103/PhysRevLett.120.090401

Lamacraft, A. (2017). Persistent currents in ferromagnetic condensates. *Phys. Rev. B*, *95*, 224512. https://doi.org/10.1103/PhysRevB.95.224512

Price, T., Kovrizhin, D. L., & Lamacraft, A. (2017). Nonlinear Luttinger liquid: Exact result for the Green function in terms of the fourth Painlevé transcendent. *SciPost Phys.*, *2*, 005. https://doi.org/10.21468/SciPostPhys.2.1.005

Price, T., & Lamacraft, A. (2014). Fine structure of the phonon in one dimension from quantum hydrodynamics. *Phys. Rev. B*, *90*, 241415. https://doi.org/10.1103/PhysRevB.90.241415

Kulkarni, M., & Lamacraft, A. (2013). Finite-temperature dynamical structure factor of the one-dimensional bose gas: From the gross-pitaevskii equation to the kardar-parisi-zhang universality class of dynamical critical phenomena. *Phys. Rev. A*, *88*, 021603. https://doi.org/10.1103/PhysRevA.88.021603

Lamacraft, A. (2013). Diffractive scattering of three particles in one dimension: A simple result for weak violations of the yang-baxter equation. *Phys. Rev. A*, *87*, 012707. https://doi.org/10.1103/PhysRevA.87.012707

Schecter, M., Kamenev, A., Gangardt, D. M., & Lamacraft, A. (2012). Critical velocity of a mobile impurity in one-dimensional quantum liquids. *Phys. Rev. Lett.*, *108*, 207001. https://doi.org/10.1103/PhysRevLett.108.207001

Lamacraft, A., & Moore, J. (2012). Chapter 7 - potential insights into nonequilibrium behavior from atomic physics. In K. Levin, A. L. Fetter, & D. M. Stamper-Kurn (Eds.), *Ultracold bosonic and fermionic gases* (Vol. 5, pp. 177–202). Elsevier. https://doi.org/https://doi.org/10.1016/B978-0-444-53857-4.00007-6

Gopalakrishnan, S., Lamacraft, A., & Goldbart, P. M. (2011). Universal phase structure of dilute bose gases with rashba spin-orbit coupling. *Phys. Rev. A*, *84*, 061604. https://doi.org/10.1103/PhysRevA.84.061604

Shi, Y., Lamacraft, A., & Fendley, P. (2011). Boson pairing and unusual criticality in a generalized XY model. *Phys. Rev. Lett.*, *107*, 240601. https://doi.org/10.1103/PhysRevLett.107.240601

Lamacraft, A. (2011). Noise correlations in the expansion of an interacting one-dimensional bose gas from a regular array. *Phys. Rev. A*, *84*, 043632. https://doi.org/10.1103/PhysRevA.84.043632

James, A. J. A., & Lamacraft, A. (2011). Phase diagram of two-dimensional polar condensates in a magnetic field. *Phys. Rev. Lett.*, *106*, 140402. https://doi.org/10.1103/PhysRevLett.106.140402

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James, A. J. A., & Lamacraft, A. (2010). Non-fermi-liquid fixed point for an imbalanced gas of fermions in $1+$ dimensions. *Phys. Rev. Lett.*, *104*, 190403. https://doi.org/10.1103/PhysRevLett.104.190403

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Lamacraft, A., Marchetti, F. M., Meyer, J. S., Moir, R. S., & Simons, B. D. (2004). Critical states in disordered superconducting films. *Journal of Physics A: Mathematical and General*, *37* (36), L447–L452. https://doi.org/10.1088/0305-4470/37/36/l01

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Lamacraft, A. (2004). Shot noise of spin-polarized electrons. *Phys. Rev. B*, *69*, 081301. https://doi.org/10.1103/PhysRevB.69.081301

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Lamacraft, A., & Simons, B. D. (2002). Phase coherence phenomena in disordered superconductors. In I. V. Lerner, B. L. Althsuler, V. I. Fal'ko, & T. Giamarchi (Eds.), *Strongly correlated fermions and bosons in low-dimensional disordered systems* (pp. 259–312). Springer Netherlands. https://doi.org/10.1007/978-94-010-0530-2_12

Lamacraft, A., & Simons, B. D. (2001). Superconductors with magnetic impurities: Instantons and subgap states. *Phys. Rev. B*, *64*, 014514. https://doi.org/10.1103/PhysRevB.64.014514

Lamacraft, A., & Simons, B. D. (2000). Tail states in a superconductor with magnetic impurities. *Phys. Rev. Lett.*, *85*, 4783–4786. https://doi.org/10.1103/PhysRevLett.85.4783