

## Curriculum Vitae

### ARJENDU K. PATTANAYAK

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#### Preparation

St. Stephen's College, Delhi University	Physics	B.Sc. (Hons), 1986
Brown University	Physics	Sc.M., 1988
University of Texas at Austin	Physics	Ph.D., 1994
University of Toronto	Post-doctoral Fellow	1995 -- 1998

#### Appointments

Ashoka University	Fulbright-Nehru Senior Scholar	2024 -- 2025
Carleton College	Professor of Physics	2011 --
Carleton College	Chair, Dept of Physics and Astronomy	2016 -- 2019
Carleton College	Associate Dean of the College	2010 -- 2013
Carleton College	Associate Professor of Physics	2007 -- 2011
Carleton College	Assistant Professor of Physics	2001 -- 2007
Rice University	Instructor & Clinical Assistant Prof Physics	1998 -- 2001

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#### Research

Entropy, information and thermodynamics: Open nonlinear quantum systems, Complex systems, Statistical thermodynamics in biophysics, Sustainable systems.

[Google Scholar](#) profile, including citation metrics

#### Refereed Journals

1. "Mapping Gene Expression Dynamics to Developmental Phenotypes with PI Entropy in *Drosophila Embryogenesis*", B Ansbacher '26, M Guzman '25, J Garcia-Ojalvo, AK Pattanayak, In preparation as invited feature paper for Entropy
2. "Ordinal pattern vector spaces and dynamical symmetries in time-series", B Ansbacher '26, A Aragonese, and AK Pattanayak, Under review at Phys. Rev. E
3. "A Chaos Synchronization Diagnostic: Difference Time Series Peak Complexity (DTSPC)", Z Lin, AK Pattanayak, Entropy, **26(12)**, 1085 (2024)
4. "Universality of Dynamical Symmetries in Chaotic Maps", M Acero '25, S Lyons '25, A Aragonese, AK Pattanayak, Entropy **26 (11)**, 969 (2024)
5. "Parametric hypersensitivity in many-body bath-mediated transport: The quantum Rabi model", C Chuang, A Kapulkin, AK Pattanayak, P Brumer, Phys. Rev. A **108**, 022213 (2023).
6. "Permutation entropy of indexed ensembles: quantifying thermalization dynamics", A Aragonese, A Kapulkin, AK Pattanayak, Journal of Physics: Complexity **4 (2)**, 02LT02 (2023)
7. "TARDYS Quantifiers: Extracting Temporal and Reversible DYnamical Symmetries", NV Nguyen, AK Pattanayak, A Aragonese, Photonics **9 (12)**, 938 (2022)
8. "Chaos in the quantum Duffing oscillator in the semiclassical regime under parametrized dissipation", AD Maris '19, B Pokharel '15, SG Seshachallam '20, MZR Misplon '17, AK Pattanayak, Phys. Rev. E **104**, 024206 (2021)

9. “*Measurement backaction control of quantum dissipation in a nonlinear cavity-based Duffing oscillator*”, Y Shi ‘22, S Greenfield ‘18, AK Pattanayak, Phys. Rev. A **103**, 052212 (2021)
10. “*Ordinal patterns in the Duffing oscillator: Analyzing powers of characterization*”, I Gunther ‘21, AK Pattanayak, A Aragonese, Chaos **31**, 023104 (2021)
11. “*Chaos and dynamical complexity in the quantum to classical transition*”, B Pokharel ‘15, MZR Misplon ‘17, W Lynn ‘16, P Duggins ‘13, K Hallman ‘12, D Anderson ‘12, A Kapulkin, AK Pattanayak, Sci. Rep. **8**, 2108 (2018)
12. “*Characterizing Complex Dynamics in the Classical and Semi-Classical Duffing Oscillator Using Ordinal Pattern Analysis*”, M Trostel ‘19, MZR Misplon ‘17, A Aragonese, and AK Pattanayak, Entropy **20**, 40 (2018)
13. “*Entanglement and its relationship to classical dynamics*”, JB Ruebeck ‘17, J Lin ‘14, and AK Pattanayak, Phys. Rev. E **95**, 062222 (2017)
14. “*Dynamics of “quantumness” measures in the decohering harmonic oscillator*”, PA Rose ‘11, AC McClung ‘10, TE Keating ‘09, ATC Steege ‘08, ES Egge, AK Pattanayak, Pramana **87**, 32 (2016)
15. “*Experimental signatures of the quantum-classical transition in a nanomechanical oscillator modeled as a damped driven double-well problem*”, Q Li ‘11, A Kapulkin, D Anderson ‘12, SM Tan ‘12, and AK Pattanayak, Physica Scripta **T151** 014055 (2012)
16. “*Persistent patterns and multifractality in fluid mixing*”, B Sundaram, A Poje, and AK Pattanayak, Phys. Rev. E **79**, 066202 (2009)
17. “*Kingsbury et al reply to Comment*”, K Kingsbury ‘09, C Amey ‘09, A Kapulkin, and AK Pattanayak, Phys. Rev. Lett. **102**, 119402 (2009)
18. “*Non-monotonicity in the quantum-classical transition: Chaos induced by quantum effects*”, A Kapulkin and AK Pattanayak, Phys. Rev. Lett. **101**, 074101 (2008)
19. “*Controlling the Ratchet Effect for Cold Atoms*”, A Kenfack, JB Gong, and AK Pattanayak, Phys. Rev. Lett. **100**, 044104 (2008)
20. “*Bifurcations and sudden current change in ensembles of classically chaotic ratchets*”, A Kenfack, SM Sweetnam ‘08, and AK Pattanayak, Phys. Rev. E. **75** 056215 (2007)
21. “*Quantum entropy dynamics for chaotic systems beyond the classical limit*”, A Gammal and AK Pattanayak, Phys. Rev. E **75**, 036221 (2007)
22. “*Coarse-grained entropy decrease and phase-space focusing in Hamiltonian dynamics*”, AK Pattanayak, DWC Brooks ‘05, A de la Fuente ‘03, L Uricchio ‘05, E Holby ‘04, D Krawisz ‘04, and JI Silva ‘04, Phys. Rev. A **72**, 013406 (2005)
23. “*Parameter Scaling in the Decoherent Quantum-Classical Transition for Chaotic Systems*”, AK Pattanayak, B Sundaram, and BD Greenbaum, Phys. Rev. Lett. **90**, 014103 (2003)
24. “*Pulse-induced focusing of Rydberg wave packets*”, D Arbó, C Reinhold, J Burgdörfer, A Pattanayak, C Stokely, W Zhao, J Lancaster, and F Dunning, Phys. Rev. A **67**, 063401 (2003)
25. “*Non-Hermiticity in a kicked model: Decoherence and the semiclassical limit*”, II Satija and AK Pattanayak, Phys. Rev. E **65**, 045205 (2002)
26. “*Transient phase-space localization*”, CL Stokely, FB Dunning, CO Reinhold, and AK Pattanayak, Phys. Rev. A **65**, 021405(R) (2002)
27. “*Stabilizing an attractive Bose-Einstein condensate by driving a low-lying surface collective mode*”, AK Pattanayak, A Gammal, CA Sackett and RG Hulet, Phys. Rev. A, **63**, 033604 (2001)

28. "Characterizing the metastable balance between chaos and diffusion," AK Pattanayak, *Physica D*, **148**, 1 (2001)
29. "Comment on Generalized Spectral Decomposition and Intrinsic Irreversibility of the Arnold Cat Map," J Wilkie, AK Pattanayak and P Brumer, *Chaos, Solitons and Fractals* **11**, 1473 (2000)
30. "Lyapunov exponents, entropy production and decoherence," AK Pattanayak, *Phys. Rev. Lett.* **83**, 4526 (1999)
31. "Exponentially rapid decoherence in quantum chaotic systems," AK Pattanayak and P Brumer, *Phys. Rev. Lett.* **79**, 4131 (1997)
32. "Chaos and Lyapunov exponents in classical and quantal distribution dynamics," AK Pattanayak and P Brumer, *Phys. Rev. E* **56**, 5174 (1997)
33. "Calculation of eigenvalues of a strongly chaotic system using Gaussian wavepacket dynamics," AK Pattanayak and WC Schieve, *Phys. Rev. E* **56**, 278 (1997)
34. "Predicting two dimensional Hamiltonian chaos," AK. Pattanayak and WC Schieve, *Z. Naturforsch.* **52a**, 34 (1997)
35. "Exponential divergence and long time relaxation in chaotic quantum dynamics," AK Pattanayak and P Brumer, *Phys.Rev.Lett.* **77**, 59 (1996)
36. "Gaussian effective potential: computation of eigenvalues," AK Pattanayak and WC Schieve, *Phys. Rev. A* **54**, 947 (1996)
37. "Semiquantal corrections to stochastic resonance," DO Reale, AK Pattanayak and WC Schieve, *Phys. Rev. E* **51**, 2925 (1995)
38. "Gaussian wave packet dynamics: semiquantal and semiclassical phase space formalism," AK Pattanayak and WC Schieve, *Phys. Rev. E* **50**, 3601 (1994)
39. "Semiquantal dynamics of fluctuations: ostensible quantum chaos," AK Pattanayak and WC Schieve, *Phys. Rev. Lett.* **72**, 2855 (1994)
40. "Effective potentials and chaos in quantum systems," AK Pattanayak and WC Schieve, *Phys. Rev. A* **46**, 1821 (1992)

### Conference Proceedings

41. "The Effects of Amplification of Fluctuation Energy Scale by Quantum Measurement Choice on Quantum Chaotic Systems: Semiclassical Analysis", Y Shi '21., S Greenfield '19, JK Eastman, ARR Carvalho, and AK Pattanayak. In: V In, P Longhini, A Palacios (Eds), *Proceedings of the 5th International Conference on Applications in Nonlinear Dynamics. Understanding Complex Systems*. Springer, Cham (2019).
42. "Symmetry breaking through autocatalysis," D Lippmann and AK Pattanayak, pg. 151, *Physical Origin of Homochirality in Life*, Ed. David B Cline, AIP Press, Woodbury, New York (1996).
43. "Semiquantal and semiclassical dynamics & Chaos," AK Pattanayak and WC Schieve, pg. 369, *Proceedings of the Fourth Drexel Symposium on Quantum Non-Integrability*, Eds. B-L Hu and D-H Feng (International Publishers, Boston, 1996).
44. "Blood coagulation is a complex system," M Hoffman, W Fortin, AK Pattanayak, and D Monroe, pg. 487, *Lecture Notes of the 1993 Complex Systems Summer School*, Eds. D Stein and L Nadel, (Addison-Wesley, 1995).
45. "Cellular automata with changing radii: a model for intraspecific competition in plant populations," AK Pattanayak and A Hübler, pg. 543. *Lecture Notes of the 1993 Complex Systems Summer School*, Eds. D Stein and L Nadel, (Addison-Wesley, 1995).

## Presentations and posters (last 5 years)

- "Thermodynamics, information entropy, and cell fates: Mapping transcriptomics to embryonic development in *Drosophila*," Lunch chalk-talk, Barcelona Collaboratorium for modeling and predictive biology, Mar 2025
- "Thermodynamics, Entropy & Divergence in Developmental Biology", B Ansbacher '26, M Guzman '26, J Garcia-Ojalvo, and AK Pattanayak, Poster at APS Global Summit, Anaheim, Mar '25
- "Nonlinearity and entanglement dynamics and some comments on international academic careers", Fulbright Fellowship Talk at Gurugram University, Nov 2024
- "Spectral bunching and quantum dynamics in the kicked top", poster R Quinn '25, A Gran '25, N Pinkney '22, A Kiral '20, S Srivastava, AK Pattanayak, SQuInT, Boulder, Oct 2024
- "Measurement choice back-action effects on energy and chaos", poster A Gran '25, Y Kuang '24, Maya Khesin '24, Yusuf Ismail '24, Sacha Greenfield '19, Justin Dressel, Arjendu Pattanayak, Boulder, SQuInT, Oct 2024
- "Nonlinearity and entanglement dynamics in (few) many-body systems", Seminar at School of Physical Sciences, Jawaharlal Nehru University, New Delhi, Sept 2024
- "My Entropyname: Stories from chasing Time's Arrow in quantum and some biological systems", Colloquium at Department of Physics, Ashoka University, Sonipat during Fulbright-Nehru semester: Aug 2024
- "Measurement choice back-action effects on energy and chaos" poster, A Gran '25, Kuang '24, Maya Khesin '24, Yusuf Ismail '24, Sacha Greenfield '19, Justin Dressel, and Arjendu K. Pattanayak at the conference on Emergence of Classicality: New Perspectives on Measurements in Quantum Theory, Trinity College, Dublin, July 2024
- "Ordinal patterns and approximate symmetry spaces," B Ansbacher '26, M Acero '25, S Lyons '25, and AK Pattanayak, contributed talk APS March Meeting 2024
- "Bifurcation diagrams for tunneling and entanglement dynamics in the kicked top", A Gran '24, R Quinn '24, N Pinkney '22, A Kiral '20, S Srivastava, AK Pattanayak, poster APS March Meeting
- "Bifurcation diagrams for tunneling and entanglement dynamics in the kicked top", R Quinn '24, A Gran '24, N Pinkney '22, A Kiral '20, S Srivastava, AK Pattanayak, SQuInT Fall 2023
- "Open Rabi system dynamics near avoided crossing quasi-degeneracies", Y Ismail '24, P Rose '10, AK Pattanayak, poster at SQuInT Fall 2023
- "Measurement back-action effects on density matrix dynamics", Y Kuang '24, M Khesin '24, Y Ismail '24, S Greenfield '19 (USC and Chapman University), J Dressel (Chapman University), and AK Pattanayak, poster at SQuInT Fall 2023
- SQuInT 2022 talk (contributed), Berkeley, Fall 2022, AK Pattanayak

## Scholarly activities, highlights (since 2020)

*Spring 2025: Sabbatical Visitor at the Barcelona Collaboratorium for Modeling and Collaborative Biology, at University of Pompeu Fabra, Barcelona. Talks, attending seminars, and regular interactions with biophysicists.*

*Fall 2024:* Fulbright-Nehru Senior Scholar at Ashoka University, Sonapat, India, Project: Open Quantum Systems and Quantum Information: Quantum Mechanics for the 21st century.

Activities: Teaching a senior elective including several graduate students, participating in student activities (research fora), advising students. Colloquium at Ashoka, seminar to graduate students at Jawaharlal Nehru University in New Delhi, as well as a Fulbright Fellowship talk at Gurugram University in Gurugram, and some collegial social interactions with the Fulbright community, including the US Ambassador to India, etc.

*2012 -- Present:* Carleton is a SQuINT (The Southwest Quantum Information and Technology) node. 2 Carleton students are funded annually (indirectly through NSF) to attend an annual workshop where they typically make presentations. I serve on the board/Steering Committee of SQuINT.

*Ongoing:* Requested to review for Quantum Information Science at NSF, The Royal Society. Ongoing reviewer for journals including Physical Review A, B, E, Letters, Physica Scripta, Journal of Physics, American Journal of Physics, Nature Advances, Nature Communications, the Pioneer Research Journal, Entropy, Scientific Reports, Parallel Computing, Chaos Solitons and Fractals, Pramana, etc. External reader for Ph.D. thesis at NUS Singapore. External departmental ten year review, Smith College (2018). External reader for tenure or promotion for colleagues most recently in Colorado, Illinois, Massachusetts, Pennsylvania, Singapore, Australia, Pakistan, India. Co-Founding current Board Member, Anacapa Society for theoretical physics at primarily undergraduate institutions (mostly dormant virtual network)

### **Teaching (since 2020)**

First-year seminar Sustainable Complex Energy Systems, Introductory Mechanics, Environmental Physics, Analytical and Computational Mechanics, Quantum Mechanics, Advanced Electricity & Magnetism, Thermal and Statistical Physics, What Physicists Do, Special Projects and Independent Studies, Senior Integrative Exercise 'Comps Czar' and individual advisor PHYS, have co-advised ENTS (Environmental Studies), GEOL (Geology).

Off-campus '24-'25

### **Carleton Service (select, since 2020)**

Steering Committee, Environmental Studies (2014 -- 2020)

Environmental Advisory Committee (2021 -- 22)

Sustainability Working Group (2022 -- 24)

Off-campus '24-'25