CURRICULUM VITAE

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Date of Birth: March 19th, 1959

Place of Birth: Rio de Janeiro, Brazil (U.S. Citizen)

Education:

Ph.D.: Theoretical Physics from the University of London, King's College London, Jul. 1986. Thesis title: *Kaluza-Klein Cosmology*
Ph.D. advisor: Prof. J.G. Taylor.

M.Sc.: Physics from the Federal University of Rio de Janeiro, Jul. 1982. Thesis title: *Gauge Field Copies and the Higgs Mechanism.*

B.Sc.: Physics from the Catholic University of Rio de Janeiro, Jul. 1981.

Honors and Awards:

- Doctor Honoris Causa – State University of Maranhão, Brazil (2020).
- 2019 **Templeton Prize** laureate.
- Doctor Honoris Causa – Pontifical Catholic University of Paraná, Brazil (2019).
- 2019 Education Leadership Award from Educando by Worldfund Foundation.
- Honorary Fellow, International Society for Science and Religion.
- **Fellow** of the American Physical Society.
- 2018 Drawbridge Lecture in Science and Religion, Saint Paul's Cathedral, London.
- Elected **Professor Extraordinarius** at the University of South Africa.
- Winner of the 2017 "Jabuti Award", the highest literary award given in Brazil, for nonfiction book "The Simple Beauty of the Unexpected".
- Winner of the 2002 "Jabuti Award", the highest literary award given in Brazil, for nonfiction book "The Prophet and the Astronomer".
- Winner of the 1998 "Jabuti Award", the highest literary award given in Brazil, for nonfiction book "The Dancing Universe: From Creation Myths to the Big Bang".
- 2016 Thomas E. Golden, Jr. Fellowship in Faith and Science Lecture, Yale University.
- 2015 Brazilian Diaspora Prize, awarded by the Brazilian government for "a Brazilian that best represents the country abroad inspiring the world with his/her work."
- 2013 Mason Library Lecture, Keene State College.
- **General Councilor** of the American Physical Society, 2013-2016.
- 2011 Distinguished Alumnus Award, Pontifical Catholic University of Rio de Janeiro
- 2011 McNair Lecture in Science and Theology, St. Andrews University.

- **Member** of the Brazilian Academy of Philosophy.

- Essay "String Theory Ties Us in Knots," published by ABC Australia, chosen for first anthology of *Best Australian Science Writing 2011*.

- Essay "Emergent Realities in the Cosmos", published in the anthology *Best American Science Writing 2003*, ed. Oliver Sacks (Ecco, HarperCollins, NY).

- Wilson Faculty Research Fellowship, Dartmouth College, 2002.

- Winner of the 2001 José Reis Prize for the Public Understanding of Science, awarded by the National Research Council of Brazil.

- Recipient of the *Appleton Chair of Natural Philosophy*, Dartmouth College, since October 1998.

- 1995 Karen E. Wetterhahn Memorial Award for Distinguished Creative or Scholarly Achievement, Dartmouth College.

- 1994-1999 Presidential Faculty Fellows Award from the National Science Foundation and White House (under President W. Clinton).

- Selected participant in the "Young Cosmologists Program" of the USA /USSR National Academy of Sciences, during June 1990 and June 1991.

- Overseas Research Student Award from the Committee of Vice Chancellors and Principals of the Universities of Great Britain (CVCP), from 10/83 to 06/86.

Editorial Boards and Boards:

Editorial Boards

- *Origins of Life and Evolution of Biospheres*, 2009-present.

- *National Geographic Magazine* (Brazil), 2005-present.

Boards

- Honorary Board Member, John Templeton Foundation.

- Board Member, Templeton World Charity Foundation.
- Advisory Board Member, Templeton Religion Trust.
- Board member of *Educando* by Worldfund, 2012-present.
- Member of the Montshire Museum Corporation, 2014-2017.

Grants:

Current:

- Principal Investigator on Templeton Foundation grant *Institute for Cross-Disciplinary Engagement at Dartmouth*, July 2015-June 2021; $4,145,147.
- Co-Principal Investigator on Department of Energy Grant *Dartmouth Theory Group at the Cosmic Frontier: The Origin and Nature of the Universe*, from April 2016-March 2020; $ 390,000.

Expired:

- Co-Principal Investigator on Department of Energy Grant *Dartmouth Theory Group at the Cosmic Frontier: The Origin and Nature of the Universe*, from April 2013-March 2016; $ 525,000.
- Principal Investigator on Templeton Foundation grant *Emergent Complexity in the Universe: Origin and Limits*, January 2013-December 2015; $247,937.
- Principal Investigator on National Science Foundation Grant No. PHY-1068027, *Cosmic Fields: Inflation and Dark Energy*, from September 2011 to August 2014; $150,000.
- Co-Principal Investigator on National Science Foundation Grant No. ISE-1010577, *Pushing the Limits: Building Capacity to Enhance Public Understanding of Math and Science Through Rural Libraries*, from Sept 2010 to August 2014; $ 2,500,000.
- Principal Investigator on National Science Foundation Grant No. PHY-0653341, *Cosmic Origin of Matter*, from July 2008 to June 2011; $ 60,000.
- Principal Investigator on National Science Foundation Grant No. PHY-0653341, *The Origin of Matter*, from July 2007 to June 2008; $15,000.

• Co-Principal Investigator (with R. R. Caldwell) on National Science Foundation Grant No. PHY-0099543, *The Physics of Dark Energy*, from September 2001 to August 2005; $ 280,000.

• Principal Investigator on National Science Foundation Grant No. PHY-0070554, *Nonequilibrium Processes in Field Theory*, from September 2000 to August 2002; $ 78,000.

• 1994 Presidential Faculty Fellow Award from the National Science Foundation and White House, from September 1994 to August 1999; $ 500,000.

• Principal Investigator on National Aeronautics and Space Administration Grant "*Primordial Sources of Gravitational Radiation*", from January 1995 to December 1998; $130,000.

• Principal Investigator on National Science Foundation Grant No. PHY-9204726 *"Cosmological Phase Transitions"*, from September 1992 to August 1995; $ 63,000.

• Co-Principal Investigator on NATO International Collaborative Research Grant, with E.J. Copeland of Sussex University, UK.

Thesis Advising:

• **Ph.D.**:

Hans-Reinhart Müller, *Numerical and Analytical Studies of Nonlinear Field Theories*, completed, June 1997.

Ronald Roberts, *Primordial Sources of Gravitational Radiation*, completed, November 1998.

Carmen Gagne, *Dynamics of Cosmological Phase Transitions*, completed, June 2001.

Krsna Dev, *The Physics of Anisotropic Spheres in General Relativity*, completed, June 2001.

Rafael Howell, *Nonequilibrium Dynamics of Emergent Field Configurations*, completed, June 2003.

Joel Thorarinson, *Emergent Coherent Structures in Nonequilibrium Field Theory*, completed, June 2008.

Sara Walker, *Origin of Chirality in Living Systems*, June 2010.

David Sicilia, *Analytical Properties of Nonlinear Fields*, May 2011.

Nikita Stamatopoulos, *Nonlinear Emergent Complexity During Cosmological Symmetry Breaking*, May 2012.

Damian Sowinski, *Complexity and Stability in Nature: The Epistemic Foundations and Phenomenology of Configurational Entropy*, June 2016.

Nan Jiang, *Stability of Physical Systems: A Configuration-Entropic Approach*, May 2017.

Michelle Stephens, *Configurational Entropy and Stability of Physical Systems*, June 2019.

Max Krakow, *Resonant Configurations in Scalar Field Theories*, June 2020.

Sara Vannah, *Information-Entropic Content of the Cosmic Microwave Sky*, in progress.

- **Master's Degree (A.M.)**:

Mark R. Briggs, *Classical Evolution of Unstable Scalar Field Configurations in 3+1 Dimensions*, June 1993.

Richard M. Haas, *Thermal Evolution of Oscillons*, October 1995.

Sheida Kourangi, The Knower and the Known: Nexus of knowledge and reality in quantum physics, May 2011.

- **Senior Honors Thesis**:

David I. Kaiser, *Inner Space, Outer Space, and the Higgs Sector*, June 1993; winner of the APS Apker Award.

Richard M. Haas, *Evolution of Gaussian Wavepackets in One Dimensional Quantum Mechanics*, June 1994.

Shayna Rich, *Groups in Particle Physics*, May 1999.

Thomas Levi, *Solitons in High Energy Physics*, May 2001.

Jeremy Althouse, *Energy Landscape for Q-Balls*, May 2004.

Doug Urban, *Lattice Approach to Stochastic Motion*, May 2005.

Lance Labun, *Stochastic Resonance in Nonlinear Oscillators*, May 2007.

Luis Martinez, *Bubbles in My Scalar Field Soup: A Study on Oscillons in Cosmology*, August 2016.

(Selected) Coordination of Conferences:

- "The Blind Spot: Experience, Reality, and Truth", Dartmouth College, April 2019.

- "Mind and Emptiness: Perspectives on the Nature of Consciousness", Dartmouth College, April 2018.

- "The Sciences, The Humanities, The Future", Dartmouth College, Sep 2016.

- Chair of New England Fall Meeting of the American Physical Society, Dartmouth, Nov 2015.

- Member of International Organizing Committee, "2nd International Workshop on Astronomy and Relativistic Astrophysics," Natal, Brazil, October 2-5, 2005.

- Coordinator of program on "Cosmological Phase Transitions" at the Institute for Theoretical Physics, University of California at Santa Barbara, January-June 1992.

- Coordinator of the "Topical Conference on Cosmological Phase Transitions" at the Institute for Theoretical Physics, University of California at Santa Barbara, April 1st-4th 1992. (Co-coordinators are E. W. Kolb and L. McLerran.)

Professional Background:

- 10/98 – present: Appleton Professor of Natural Philosophy, Dartmouth College.

- 07/2016 – present: Director, Institute for Cross-Disciplinary Engagement at Dartmouth.

- 07/98 – present: Professor of Physics and Astronomy, Dartmouth College. Research topics include: 1. the interface of particle physics and cosmology, in particular the dynamics of primordial phase transitions, and statistical field theory applied to

the early Universe; 2. nonperturbative aspects of field theories and the emergence of complex collective behavior in stochastic field theories; 3. The origin of life's chirality and general studies of astrobiology.

- 07/95 – 06/98: Associate Professor of Physics and Astronomy, Dartmouth College.

- 09/91 – 06/95: Assistant Professor of Physics and Astronomy, Dartmouth College.

- 09/88 – 08/91: Postdoctoral Fellow at the Institute for Theoretical Physics, University of California at Santa Barbara.

- 09/86 – 08/88: Postdoctoral Research Associate at the Fermilab Theoretical Astrophysics Group.

List of Publications

1. Higgs Fields as Bargmann-Wigner fields and Classical Symmetry Breaking (with A.F.F. do Amaral and F.A. Doria), J. Math Phys. **24**, 1888 (1983).

2. Cosmologies in Ten Dimensions (with S. Rajpoot and J.G. Taylor), Phys. Lett. **B138**, 37 (1984).

3. Search for Higher Dimensional Cosmologies (with S. Rajpoot and J.G. Taylor), Phys. Rev. **30**, 756 (1984).

4. Higher Dimensional Cosmologies (with S. Rajpoot and J.G. Taylor), *Ann. Phys.* **160**, 229, (1984).

5. Time Variation of Coupling Constants in Kaluza-Klein Cosmologies (with J.G. Taylor), Phys. Rev. **D31**, 1904 (1985).

6. Time Variation of Coupling Constants in Kaluza-Klein Cosmologies Reexamined (with J.G. Taylor), Phys. Rev. **D33**, 570 (1986).

7. Very Hot Superstrings (with J.G. Taylor), Phys. Lett. **B164**, 36 (1985).

8. On Kaluza-Klein Cosmologies, Proceedings of the 12th Texas Symposium on Relativistic Astrophysics, ed. M. Livio and G. Shaviv, *Ann. N.Y. Acad. Sci.* **470**, 374 (1986).

9. Toward Stable Compactifications (with F.S. Accetta, R. Holman and E.W. Kolb),

Nucl. Phys. **B276**, 501 (1986).

10. Classical Cosmologies from Ten Dimensional Supergravity (with J.A. Stein-Schabes), Phys. Rev. **D34**, 1739 (1986).

11. Einstein-Kalb-Ramond Cosmology (with J.A. Stein-Schabes), Phys. Rev. **D34**, 3242 (1986).

12. Thermodynamics of Higher Dimensional Black Holes (with F.S. Accetta), Ann. Phys. (NY) **176**, 278 (1987).

13. Vacuum Energy of $M^4 \times S^M \times S^N$ in Even Dimensions (with P. Jetzer and M.A. Rubin), Phys. Rev. **D36**, 2429 (1987).

14. Cosmological Stability of Quantum Compactification, Proceedings of the 13th Texas Symposium on Relativistic Astrophysics, ed. M.P. Ulmer, *World Scientific*, Singapore (1987).

15. Stars of Bosons with Non-Minimal Energy-Momentum Tensor (with J.J. van der Bij), Phys. Lett. **194B**, 482 (1987).

16. First Order Formalism for Quantum Gravity (with R. Holman and N. Neto), Nucl. Phys. **B294**, 1164 (1987).

17. Primordial Formation of Non-Topological Solitons (with J. Frieman, G.B. Gelmini and E.W. Kolb), Phys. Rev. Lett. **60**, 2101 (1988).

18. Stability of Boson Stars, Phys. Rev. **D38**, 2376 (1988).

19. Cosmology of Biased Discrete Symmetry Breaking (with G.B. Gelmini and E.W. Kolb), Phys. Rev. **D39**, 1558 (1989).

20. Gravitational Stability of Scalar Matter (with R. Watkins), Nucl. Phys. **B319**, 733 (1989).

21. Gravitational Radiation from Primordial Solitons and Soliton Star Binaries, Phys. Rev. Lett. **63**, 1199 (1989).

22. Gravitational Atoms : Gravitational Radiation from Excited Boson Stars (with R. Ferrell), Phys. Rev. **D40**, 2524 (1989).

23. Cosmic Evolution of Non-Topological Solitons (with J. Frieman, A. Olinto, and

C. Alcock), Phys. Rev. **D40**, 3241 (1989).

24. Solitonic Dark Matter and The Solar Neutrino Problem (with J. Bartlett and J. Silk), Nucl. Phys. **B339**, 407 (1990).

25. Large Scale Anisotropy in the Extragactic γ-ray Background as a Probe for Cosmological Antimatter (with D. B. Cline, Y.-T. Gao and F. W. Stecker), Ap. J. Lett. **361**, L37 (1990).

26. Metastability in the Early Universe, Phys. Rev. **D42**, 3350 (1990).

27. Phase Transitions with Sub-Critical Bubbles (with E. W. Kolb and R. Watkins), Nucl. Phys. **B364**, 411 (1991).

28. Thermal Nucleation of Kink-Antikink Pairs (with M. Alford and H. Feldman), Phys. Rev. Lett. **68**, 1645 (1992).

29. Fluctuation Driven Electroweak Phase Transition (with E.W. Kolb), Phys. Rev. Lett. **69**, 1304 (1992).

30. Thermal Activation of Metastable Decay: Testing Nucleation Theory (with M. Alford and H. Feldman), Phys. Rev. **D47**, 2168 (1993).

31. Critical Behavior in the Electroweak Phase Transition (with E. W. Kolb), Phys. Rev. **D48**, 1560 (1993).

32. The Electroweak Phase Transition (with E. W. Kolb), Int. J. Mod. Phys. **C3**, 773 (1992).

33. Thermal Fluctuations and Validity of the 1-loop Effective Potential (with R. O. Ramos), Phys. Lett. **300B**, 271 (1993).

34. Kinetics of Sub-Critical Bubbles and the Electroweak Transition (with G. B. Gelmini), Nucl. Phys. **B419**, 129 (1994).

35. Metastability in Two Dimensions and the Effective Potential (with M. Alford), Phys. Rev. **D48**, 2838 (1993).

36. Evaluation of Thermal Corrections to False Vacuum Decay Rates (with G.C. Marques and R.O. Ramos), Phys. Rev. **D48**, 1571 (1993).

37. Sub-Critical Fluctuations and Kinetics of the Electroweak Phase Transition, Ann.

N.Y. Acad. Sci. **V. 688**, 666 (1993).

38. Dynamics of Cosmological Phase Transitions: Metastability Revisited (with E.W. Kolb), Vistas Astron., **37**, 429 (1993).

39. Pseudo-Stable Bubbles, Phys. Rev. D **49**, 2978 (1994).

40. Microphysical Approach to Nonequilibrium Dynamics of Quantum Fields, with R.O. Ramos, Phys. Rev. D **50**, 2441 (1994).

41. Dynamics of Weak First Order Phase Transitions, Phys. Rev. Lett. **73**, 3495 (1994).

42. Thermal Phase Mixing During First Order Phase Transitions, with J. Borrill, Phys. Rev. **D51**, 4111 (1995).

43. Oscillons: Resonant Configurations During Bubble Collapse, with E.J. Copeland and H.-R. Müller, Phys. Rev. D **52**, 1920 (1995).

44. Nonperturbative Effects on Nucleation, with A. Heckler, Phys. Rev. Lett. **76**, 180 (1996).

45. Oscillons in a Hot Heat Bath, with R. Haas, Phys. Rev. **D54**, 1626 (1996).

46. Matching Numerical Simulations to Continuum Field Theories: A Lattice Renormalization Study, with J. Borrill, Nucl. Phys. B **483**, 416 (1997).

50. Strong Dissipative Behavior in Quantum Field Theory, with A. Berera and R. Ramos, Phys. Rev. **D58**, 123508 (1998).

51. Gravitational Radiation from Collapsing Vacuum Domains, with R. Roberts, Phys. Rev. Lett. **81**, 5497 (1998).

52. How to Count Kinks: From the Coninuum to the Lattice and Back, with H.-R.-Müller, Phys. Lett. B **422**, 69 (1998).

53. A First Principles Warm Inflation Model that Solves the Cosmological Horizon/Flatness Problems, with A. Berera and R. Ramos, Phys. Rev. Lett. **83**, 264 (1999).

54. First Order Phase Transitions in Cosmology, with L. Amendola, C. Baccigalupi and F. Occhionero, New Ast. **4**, 339 (1999).

55. Long-lived Localized Configurations in Small Lattices: Application to Oscillons, with A. Sornborger, Phys.Rev. E62 (2000) 1368.

56. Lattice-Independent Approach to Thermal Phase Mixing, with C. Gagne, Phys.Rev. E61 (2000) 3483.

57. Weakly First-Order Cosmological Phase Transitions and Fermion Production, with M. Trodden, Phys. Lett. B **517** (2001) 7.

58. Inhomogeneous nucleation in quark-hadron phase transition, with P. Shukla, A.K. Mohanty, and S.K. Gupta, Phys. Rev. C62 (2000) 054904.

59. Nonperturbative Effects in Rapidly Expanding Quark-Gluon Plasmas, with A.K. Mohanty and P. Shukla, Phys. Rev. C **65** (2002) 034908.

60. Anisotropic Stars: Exact Solutions, with Krsna Dev, Gen. Rel. Grav. **24** (2002) 1793.

61. Nonequilibrium Precursor Model for the Onset of Percolation in a Two-Phase System, with Rafael Howell and Rudnei Ramos, Phys. Rev. E **65** (2002) 036113.

62. Quantifying Nonequilibrium Behavior with Varying Cooling Rates, with Carmen Gagne, Physica D **181** (2003) 121.

63. Equilibration Time Scales in Homogeneous Bose-Einstein Condensate Dynamics, with D. G. Barci, E. S. Fraga and R. Ramos, Physica A **317** (2003) 535.

64. Gauged Fermionic Q-Balls, with T. S. Levi, Phys. Rev. D **66** (2002) 087701.

65. Long-lived Oscillons from Asymmetric Bubbles, with A. Adib and C. A. S. Almeida, Phys. Rev. D **66** (2002) 085011.

66. Resonant Emergence of Local and Global Spatiotemporal Order in a Nonlinear Field Model, with R. Howell, Phys. Rev. E **68**, 065203(RC) (2003).

67. Anisotropic Stars II: Stability, with Krsna Dev, Gen. Rel. Grav. **35** (2003) 1435-1457.

68. Resonant Nucleation of Spatiotemporal Order Via Parametric Modal Amplification, with R. Howell (cond-mat/0310157).

69. d-Dimensional Oscillating Scalar Field Lumps and the Dimensionality of Space, Phys. Lett. B **600**, 126 (2004).

70. Resonant Nucleation, with R. Howell. Phys. Rev. Lett. **94**, 151601 (2005).

71. Energy Landscape of d-Dimensional Q-balls, with Joel Thorarinson, Phys. Rev. D **73**, 065008 (2006).

72. Prebiotic Homochirality as a Critical Phenomenon, with Joel Thorarinson, Origins of Life and Evolution of Biospheres, **36**, 501-505 (2006) [astro-ph/0601399].

73. Oscillons in Scalar Field Theories: Applications in Higher Dimensions and Inflation, Int. J. Mod. Phys. D **16**, 219 (2007) [hep-th/0602187].

74. Asymmetric Spatiotemporal Evolution of Prebiotic Homochirality, Origins of Life and Evolution of Biospheres, **37**, 235-251 (2007) [astro-ph/0606593].

75. Emergence of Complex Spatio-Temporal Order in Nonlinear Field Theories, Braz. J. Phys. **36**, 1150 (2006).

76. A Phase Transition in U(1) Configuration Space: Oscillons as Remnants of Vortex-Antivortex Annihilation, with Joel Thorarinson, Phys. Rev. D **76**, 041701(R) (2007).

77. Bubbling the False Vacuum Away, with Barrett Rogers and Joel Thorarinson, Phys. Rev. D **77**, 023513 (2008).

78. Running-mode resonance in A.C.-biased periodic potential, with Lance Labun. [arXiv:0801.3221]

79. Punctuated Chirality, with Joel Thorarinson and Sara I. Walker, Orig. Life Evol. Biosph. **38**, 499-508 (2008). [arXiv:0802.1446].
See also, http://www.nature.com/news/2008/080215/full/news.2008.571.html

80. An Extended Model for the Evolution of Prebiotic Homochirality: A Bottom-Up Approach to the Origin of Life, with Sara Walker, Orig. Life Evol. Biosph. **38**, 293-315 (2008). [arXiv:0802.2884].

81. An Analytical Characterization of Oscillons: Their Energy, Radius, Frequency, and Lifetime, with David Sicilia, Phys. Rev. Lett. **101**, 011602 (2008). [arXiv:0804.0791].

82. A Class of Nonperturbative Configurations in Abelian-Higgs Models: Complexity from Dynamical Symmetry Breaking, with Joel Thorarinson, Physical Review D **79**, 025016 (2009), [arXiv:0808.0514].

83. Toward Homochiral Protocells in Noncatalytic Peptide systems, with Sara Walker, Orig. Life. Evol. Biosph. **39**, 479 (2009) [arXiv:0810.5398].

84. The Chirality of Life: From Phase Transitions to Astrobiology, with Sara Walker, DOI: 10.1142/9789814304887_0002.
(http://eproceedings.worldscinet.com/9789814304887/9789814304887_0002.html [arXiv: 0811.1291].

85. General Theory of Oscillon Dynamics, with David Sicilia, Phys. Rev. D **80**, 125037 (2009) [arXiv:0910.5922].

86. Drake Equation for the Multiverse: From the String Landscape to Complex Life, Int. J. Mod. Phys. D **19**, 1299 (2010) [arXiv:1002.1651].

87. Long-lived Time-Dependent Remnants During Cosmological Symmetry Breaking: From Inflation to the Electroweak Scale, with N. Graham and N. Stamatopoulos, Phys. Rev. D **82**, 043517 (2010) [arXiv:1004.4658].

88. Generation of Coherent Structures After Cosmic Inflation, with N. Graham and N. Stamatopoulos, Phys. Rev. D **83**, 096010 (2011). [arXiv:1103.1911]

89. Entropic Measure for Localized Energy Configurations: Kinks, Bounces, and Bubbles, with N. Stamatopoulos, Phys. Lett. B **713**, 304 (2012). [arXiv:1111.5597].

90. Chiral Polymerization in Open Systems from Chiral-Selective Reaction Rates, with B. Nelson and S. I. Walker, Orig. Life Evol. Biosph. **42**, 333-346 (2012). [arXiv:1112.1393].

91. From Cosmos to Intelligent Life: The Four Ages of Astrobiology, Int. J. Astrobiology **11**, 345-350 (2012) [arXiv: 1202.5042].

92. Life's Chirality From Prebiotic Environments, with S. I. Walker, Int. J. Astrobiology **11**, 287-296 (2012) [arXiv:1202.5048].

93. Information Content of Spontaneous Symmetry Breaking, with N. Stamatopoulos, Phys. Rev. D **86**, 045004 (2012) [arXiv:1205.3061].

94. Information-Entropic Stability Bound for Compact Objects: Application to Q-Balls and the Chandrasekhar Limit of Polytropes, with D. Sowinski, Phys. Lett. B **727**, 272-275 (2013) [arXiv:1307.0530].

95. Transition to Order After Hilltop Inflation, with Noah Graham, Phys. Rev. D **89**. 083502 (2014) [arXiv:1401.6225].

96. Information-Entropic Measure of Energy-Degenerate Kinks in Two-Field Models, with R. A. C. Correa e A. de Souza Dutra, Phys. Lett. B **737**, 388-394 (2014). [arXiv:1409.0029].

97. Information-Entropic Signature of the Critical Point, with D. Sowinski, Phys. Lett. B **747**, 125 (2015) [arXiv:1501.06800]. DOI: 10.1016/j.physletb.2015.05.058

98. Stability Bounds on Compact Astrophysical Objects from Information-Entropic Measure, with Nan Jiang, Phys. Rev. D **92**, 044046 (2015) [arXiv:1506.05722v1].

99. A Cyclic Universe Approach to Fine Tuning, with Stephon Alexander and Sam Cormack, Phys. Lett. B. **757**, 247 (2016) [arXiv:1507.00727].

100. Information Dynamics at a Phase Transition, with Damian Sowinski, J. Stat. Phys. **167**, 1221-1232 (2017) DOI 10.1007/s10955-017-1762-6 [arXiv:1606.09641].

101. Predicting Atomic Decay Rates Using an Informational-Entropic Approach, with Nan Jiang, published Int. J. Theor. Phys., **76**, 1691-1704 (2018), https://doi.org/10.1007/s10773-018-3695-5. [arXiv: 1703.06818].

102. How We Make Sense of the World: Information, Map-Making, and The Scientific Narrative, with Damian Sowinski, To appear in *Map and Territory - Exploring the Foundations of Science, Thought and Reality*, ed. by Shyam Wuppuluri, Newton da Costa, and Francisco Antonio Doria (Springer, Frontiers Collection), [arXiv: 1710.09944]

103. Cosmic Metaphysics: Being versus Becoming in Cosmology and Astrophysics, HTS Teologiese Studies/Theological Studies 73(3), a4713. https://doi.org/10.4102/hts.v73i3.4713; Nov. 2017.

104. Gravitational Radiation Background from Boson Star Binaries, with Djuna Croon, Sonali Mohapatra, and Chen Sun, Physics Letters B **783** 158-162) (2018), DOI: 10.1016/j.physletb.2018.03.055 [arXiv:1802.08259]

105. Shape Is Destiny I: Configurational Entropy as Lifetime Predictor and Pattern Discriminator for Oscillons, with Michelle Stephens and Damian Sowinski, Physical Review D**97** 096007 (2018), DOI:https://doi.org/10.1103/PhysRevD.97.096007, [arXiv:1803.08550]

106. Shape Is Destiny II: Configurational Information Approach to Instantons and False Vacuum Decay in D-dimensional Spacetime, with Damian Sowinski, Physical Review D **98** 056026 (2018) DOI:https://doi.org/10.1103/PhysRevD.98.056026, [arXiv:1807:07588]

107. Informational Approach to Cosmological Parameter Estimation, with Michelle Stephens and Sara Vannah, Physical Review D **102**, 123514 (2020), [arXiv:1905.07472] [astro-ph.CO]

108. Resonant Configurations in Scalar Field Theories: Can (Some) Oscillons Live Forever?, with Max Krackow, Physical Review D**100**, 116005 (2019). [arXiv:1906.04070] [hep-th].

109. Configurational Entropy of Optical Bright Similariton in Tapered Graded-Index Waveguide, with P. Thakur, A. Kumar, and R. Gupta, Physics Letters A **384** (2020) 126461.

110. Configurational Entropic Study of the Enhanced Longevity in Resonant Oscillon, with Max Krackow, Physics Letters B **805** (2020) 135450, [arXiv:2003.10899][hep-th].

111. Configurational complexity of nonautonomous discrete one-soliton and rogue waves in Ablowitz-Ladik-Hirota waveguide, with P. Thakur, A. Kumar, and R. Gupta, Physics Letters A (2020).

Selected Invited Contributions to Conferences

1. On the Strength of First Order Phase Transitions, Dartmouth preprint No. DART-HEP-94/02, in *Electroweak Physics and the Early Universe*, NATO Advanced Research Workshop, Sintra, Portugal, 23–25 March, 1994. Published in Proceedings.

2. Baryogenesis in Brief, Dartmouth preprint No. DART-HEP-94/03, in *The Birth of the Universe and Fundamental Physics*, Rome, May 18–21, 1994. Published in Proceedings.

3. Dynamics of Weak First Order Phase Transitions: Applications to Electroweak

Baryogenesis, Dartmouth preprint No. DART-HEP-94/04, in *2éme Journee Cosmologie*, Paris, June 2–4, 1994. Published in Proceedings.

4. Thermal Mixing of Phases: Numerical and Analytical Studies, Dartmouth preprint No. DART-HEP-95/03, in *3émme Colloque Cosmologie*, Paris, June 7–9, 1995. Published in Proceedings, ed. N. Sanchez.

5. Origin of Matter in the Universe: A Brief Review, Dartmouth preprint No. DART-HEP-96/02, in *VI Brazilian Conference on Particles and Fields*, Caxambu; Brazil, October 8–12, 1995. Published in Proceedings.

6. Phase Transitions: An Overview with a View, Fermilab preprint No. Fermilab-Conf-97/324-A, October 1997, in *Fundamental Physics at the Birth of the Universe II*, Rome, May 19-24 1997. Published in the Proceedings, ed. F. Occhionero.

7. Two Lectures on Phase Mixing, in *Field Theoretical Tools in Polymer and Particle Physics*, Dartmouth preprint No. DART-HEP-97/06, November 1997, Wuppertal, June 17-19 1997. Published in the Proceedings.

8. Gravitational Waves from Discrete Symmetry Breaking, in *COSMO-98*, Monterey, CA, November 1998. Ed. by D. Caldwell, (AIP Conference Proceedings 478, New York, 1999).

9. Anisotropic Stars, in *IX Marcelo Grossman Meeting on General Relativity*, Rome, Italy, July 2000.

10. Phase Transitions in the Early Universe, in *Third Greater Boston Area Statistical Mechanics Conference*, Boston, October 2001.

11. The Problem of the 3 Origins: Cosmos, Life, and Mind, in *Science and Ultimate Reality: a Celebration of John A. Wheeler's vision*, Princeton, NJ, March 18th, 2002. Proceedings edited by John Barrow, Paul C. W. Davies, and Charles Harper (Cambridge University Press, Cambridge, UK 2004).

12. Baryogenesis: A Fresh Look, in *XXXVIIth Rencontres de Moriond: The Cosmological Model*, Les Arcs, France, March 2002. Proceedings edited by Y. Giraud-Héraud, C. Magneville, and J. T. Thanh Vân.

13. What We Know and What We Don't Know About the Universe, keynote address at *International Worskhop on Astronomy and Relativistic Astrophysics*, Olinda, Brazil, October 2003; Int. J. Mod. Phys. D **13** 2004. (astro-ph/0401213).

14. Anisotropic Stars: Exact Solutions and Stability, in *International Worskhop on Astronomy and Relativistic Astrophysics*, Olinda, Brazil, October 2003, Int. J. Mod. Phys. D **13** 2004. (astro-ph/0401546).

15. Live Free or Die: Dartmouth Students Speak on Liberal Arts Education, in *The Liberal Education, Dead or Alive?*, Dartmouth College, Nov 5-7 2004.

16. Telling the Cosmological Story, in *Science, Theatre, and Performance*, a workshop at the Institute for Theoretical Physics, UCSB, March 2-5 2005.

17. Emergence of Complex Spatio-Temporal Behavior in Nonlinear Field Theories, with R. Howell, in *Albert Einstein Century*, ed. by J.-M. Alimi and A. Fürza, Paris, July 2005. (American Institute of Physics Proceedings Series.)

18. *d*-Dimensional Solitons, in *Albert Einstein Century*, ed. by J.-M. Alimi and A. Fürza, Paris, July 2005. (American Institute of Physics Proceedings Series.)

19. Revisiting Old Inflation, in *II International Workshop on Astronomy and Relativistic Astrophysics*, Natal, Brazil, October 2005.

20. Emergence of Complex Spatiotemporal Order in Nonlinear Field Theories, in XXIV Brazilian Conference of Particles and Fields, Caxambú, Brazil, October 2005.

21. Thoughts on Life and Design, Here and Elsewhere in the Cosmos, in *XXVII Darwin Festival*, Salem State College, February 2006. Also at Middlebury College, April 6th 2006; New York University, Undergraduate Research Lecture, April 21st, 2006.

22. From The Shield of Achilles to the Multiverse: A Whirlwind Tour of Cosmological Thought, inaugural sophomoric lecture, Green Mountain College, March 2006.

23. What We Know and What We Don't Know About the Universe. Keynote address, *Gordon Research Conference*. New Hampshire, August 2007.

24. "Oscillons in Field Theories: The Lumps that Wouldn't Die", in *Classical Field Theory Meeting*, University of Durham, UK., September 2007.

25. "The Harmony of the World", in V National Conference in Art and Aesthetics, University of São Paulo, Brazil, October 2007.

26. "Punctuated Chirality," in *Homochirality in Biology*, Beyond Center for Fundamental Questions, Arizona State University, March 2010.

27. "The Limits of Knowledge," in *Laws of Nature*, Perimeter Institute for Fundamental Physics, May 2010.

28. "Emergent Complexity in Field Theory," in *Is There a General Principle of Increasing Complexity?*, Arizona State University, December 2010.

29. "From Cosmos to Intelligent Life: The Four Ages of Astrobiology," Opening plenary talk delivered at the São Paulo Advanced School of Astrobiology, São Paulo, December 2011.

30. "Emergent Complexity in the Universe: Origin and Limits," invited lecture for award winners in the New Frontiers in Astronomy and Cosmology grant opportunity from the Templeton Foundation; Franklin Institute, Philadelphia, PA, October 13, 2012.

31. "A Conversation on Science and Religion with Marilynne Robinson and Krista Tippett," as part of the Center for Theological Inquiry conference on Spiritual Progress, American Philosophical Society, Philadelphia, October 15, 2012.

32. "Emergent Complexity in the Universe," University of Chicago, New Frontiers in Astronomy and Astrophysics program, June 17, 2014.

33. "Big Bang and the Nature of Truth,", a Wilton Park/CERN conference, Chateau Devonne, France, June 23-25, 2014.

34. "Cosmic Metaphysics: Being vs. Becoming in Cosmology and Astrophysics," University of South Africa, Pretoria, June 2016.

35. "Knowns and Unknowns in Heaven and Earth," Drawbridge Lecture in Science and Religion, St. Paul's Cathedral, May 2018.

36. "Mapping the Quantum Territory," Quantum Indeterminacy, Dartmouth College, July 2019.

Marcelo Gleiser

BOOKS

Published in the US, Brazil, and other countries:

1. *The Dancing Universe: From Creation Myths to the Big Bang.* Published by Dutton-Penguin Books in November 1997. [Paperback: November 1998 by Plume.] Portuguese Translation (my own) published by Companhia das Letras in August 1997. German Translation published in Fall 1998. New edition, University Press of New England, Spring 2005. Winner Prêmio Jabuti, Best Nonfiction, Brazil 1998.

2. *The Prophet and the Astronomer: A Scientific Journey to the End of Time.* Published by W. W. Norton in the US and UK in May 2002. [Paperback: May 2003] Portuguese Translation (my own) published by Companhia das Letras in Brazil in August 2001.Winner Prêmio Jabuti, Best Nonfiction, Brazil 2002.

3. *A Tear at the Edge of Creation: A Radical New Vision for Life in an Imperfect Universe.* (Published in 12 languages so far: Simon & Schuster, Free Press (US, UK, 2010); Ed. Record (Brazil); Paradigma (Holland); Rizzoli (Italy); Black Inc. (Australia/NZ); Kachi Publishing (Korea); Post Publishing (Thailand); Springer (Germany); Letras e Expressões (Portugal); Flammarion (France); Dokoran (Czech Rep.).

4. *The Island of Knowledge: The Limits of Science and The Search for Meaning*, Basic Books (US, UK, July 2014); Editora Record (Brazil); Temas & Debates (Portugal); Beijing Alpha Books (China); Hakuyo-sha (Japan); Piter Press (Russia); And Grace Publishing House (Taiwan).

5. *The Simple Beauty of the Unexpected: A Natural Philosopher in Search of Trout and the Meaning of Everything*, University Press of New England (US, 2016); Editora Record (Brazil, 2016). Winner Prêmio Jabuti, Best Nonfiction, Brazil 2018.

Published in Brazil Only:

1. *Retalhos Cósmicos: Ensaios sobre a natureza da ciência e da ciência da Natureza* [Cosmic Patchwork: Essays on the Science of Nature and the Nature of Science.] A collection of my essays published on Folha de São Paulo from September 97 to December 98. Published in Portuguese by Companhia das Letras in April 1999.

2. *O Livro do Cientista* [The Book of the Scientist]. A children's book in Portuguese published by Companhia das Letras (Brazil) in May 2003.

3. *Micro/Macro: Reflexões sobre o Tempo, Espaço e o Homem* [Micro/Macro: Reflections on Time, Space, and Man], anthology of 380 texts written for Brazilian newspaper Folha de São Paulo. (PubliFolha Editions, 2005).

4. *The Harmony of the World: A Biographical Novel of Johannes Kepler*, Published by Companhia das Letras (Brazil) in August 2006 under the title *A Harmonia do Mundo*.

5. *Poeira das Estrelas* [Stardust], the companion volume to the 12-part documentary series I wrote and anchored for TV Globo, Brazil (Editora Globo, 2006).

6. *Cartas a um Jovem Cientista* [Letters to a Young Scientist], in Portuguese, (Editora Campus-Elsevier, 2007).

7. *Mundos Invisíveis* [Invisible Worlds], in Portuguese, the companion volume to the 10-part documentary series I wrote and anchored for TV Globo, Brazil (Editora Globo, 2008).

8. *Micro/Macro 2: Mais Reflexões sobre o Tempo, Espaço e o Homem* [Micro/Macro: More Reflections on Time, Space, and Man], a collection of texts written for the Brazilian newspaper Folha de São Paulo from 2004 to 2007. Spring 2007 (PubliFolha Editions).

9. *Conversa Sobre a Fé e a Ciência* [Conversation on Faith and Science], with Frei Betto. In Portuguese, (Editora Agir, 2011).

10. *À Escuta do Infinito: Estamos Mais Perto de Deus? Um Encontro entre Marcelo Gleiser e Gianfranco Ravasi* [Listening to Infinity: Are We Closer to God? A Dialogue between Marcelo Gleiser and Gianfranco Ravasi], (PUCPRESS, Curitiba, Brasil, 2018).

11. *O Caldeirão Azul: O Universo, o Homem e seu Esprito* [The Blue Cauldron: The Universe, Man, and His Spirit], (Ed. Record, Rio de Janeiro, 2019).

Selected Essays (English Only)

• Co-founder and writer of science and culture blog for *National Public Radio* since December 2009 (over 420 essays and book reviews). A complete archive can be found at
http://www.npr.org/people/336057477/marcelo-gleiser/archive

• Writer and essayist on science and culture for *Orbiter Magazine* since May 2018 (over 60 essays so far). A complete archive can be found at

https://orbitermag.com/author/marcelo-gleiser/

• Weekly science and society column for the newspaper *Folha de São Paulo*, the largest circulation newspaper in Brazil, since September 1997. (Over 700 essays also published in 3 volumes.)

• *The Myths of Science*, in The UNESCO Courier, May 2001.

• *Phase Transitions*, entry in the Encyclopedia of Physics: Particle Physics Supplement, Macmillan Reference, November 2002.

• *Myth*, entry in the Encyclopedia of Science and Religion, Macmillan Reference, December 2002.

• *Emergent Realities in the Cosmos*, in *Spiritual Information: 100 Perspectives*, ed. by C. L. Harper. Jr. (Templeton Foundation Press, 2005). **Selected for "Best American Science Writing" anthology**, ed. Oliver Sacks, (Ecco, NY, 2003).

• *Creation and the Origin of the Universe*, invited essay for Science, Religion, and Society: History, Culture, and Controversy, ed. by G. Laderman and A. Eisen, in press (2004).

• Review of *Heavenly Intrigue; Johannes Kepler, Tycho Brahe, and the murder behind one of histories's greatest scientific discoveries* (Doubleday, New York, 2004), by Joshua and Anne-Lee Gilder, for Jornal of the History of Astronomy. July 2004.

• *Einstein's Tie*, invited essay for *My Einstein*, edited by John Brockman, (Pantheon, 2006).

• *Cosmic Birth*, Harvard Divinity Bulletin, Spring 2005.

• *On Science and Religion*, two essays published in "Secrets of Angels and Demons," edited by Dan Burstein (CDS Books, 2004).

• Review of *First Course on String Theory* by Barton Zwiebach, Physics Today, **58**, pg. 57 (2005).

• *Who Designed the Designer?*, an op-ed at the Boston Globe, August 29, 2005.

• *Being Human in the Cosmic Garden*, an essay in Science and Theology News, Spring 2006.

• *It's OK Not to Know Everything*, an essay published in *What is Your Dangerous Idea?*, ed. by John Brockman (Harper Perennial, 2007).

• *The War Between Science and Religion Will See New Light*, an essay published in *What Are You Optimistic About?*, ed. by John Brockman (Harper Perennial, 2007).

• *To Unify or Not to Unify?*, an essay published in *What Have You Changed Your Mind About?*, ed. by John Brockman (Harper Perennial, 2008).

• *Mastering Death*, an essay published in *What Would Change Everything?*, ed. by John Brockman (Harper Perennial, 2009).

• *How Do We Know?*, invited contribution to blog "Cosmic Variance," 03.18.2009. http://blogs.discovermagazine.com/cosmicvariance/2009/03/23/guest-post-marcelo-gleiser-on-how-do-we-know/

• *Science and Religion Meet the Beyond*, invited contribution to "Secrets of the Lost Symbol," eds. Dan Burstein and Arne de Kejzer, 2009.

• *The Asymmetry of Life*, invited contribution to SEED magazine, May 2009.

• *Introduction to* **The Theory of Everything by Stephen Hawking**, (Phoenix Books, Los Angeles, 2010).

• *Unification and the Limits of Knowledge*, fourth place in "What is Ultimately Possible in Physics", organized by the FQXi Foundation, October 2009.

• *Imperfect Creation: A New Vision for Humanity*, essay written for Powells Books, Feb 2010.

• *The Imperfect Universe: Can our knowledge of Nature ever be Complete?*, New York Academy of Sciences Magazine, Spring 2010.

• *The Imperfect Universe: It's Time to Let Go of Our Dreams of a Final Theory*, New Scientist, May 8th, 2010.

• *Perfectly Imperfect*, GEO, German Magazine, September 2010.

• *Giving Up the Ghost*, COSMOS, Australian science magazine, OCT/Nov 2010.

• *Empirical Incompleteness and the Search for a Theory of Everything*, Physics Today, September 2010, pg. 8.

• *Empirical Incompleteness and the Laws of Nature*, in *A Life of Achievements, a Festschrift on the occasion of Alberto Santoro's 70th birthday*, edited by F. Caruso, E. Christoph, V. Oguri & R. Rubinstein (AIAFEX editora, Rio de Janeiro, Brazil, 2011).

• *The Known, the Unknown, and the Unknowable*, The 2011 John Calvin McNair Lecture in Science and Theology, St. Andrew's University, October 2011.

• *Emergent Complexity in Field Theory*, to appear in *The Self-Organizing Universe: Cosmology, Biology, and the Rise of Complexity*, edited by Charles Lineweaver, Paul Davies, and Michael Ruse (Cambridge University Press, 2012).

• *We Are Unique*, in *This Will Make You Smarter*, edited by John Brockman (Harper Perennial, 2012).

• *There's so much that science will never be able to explain*, Washington Post, July 14th, 2014.

• *Does Consciousness Compute?*, Chronicle of Higher Education, September 8th, 2014.

• *Unification*, in *This Idea Must Die: Scientific Theories that are Blocking Progress*, edited by John Brockman (Harper Perennial, 2015).

• *Why We Matter - To the Multiverse and Back*, Slate.com, Big Ideas project. (July 2014).

• *Is God Necessary?*, Los Angeles Review of Books. (May 2015) http://lareviewofbooks.org/review/is-god-necessary

• *Meaning in a Silent Universe*, The New Atlantis (Fall 2015), pg. 76-86.

• *Casting into the Unknown*, The Chronicle Review, Chronicle of Higher Education (September 2, 2016).

• *Cosmic metaphysics: Being vs. Becoming in Cosmology and Astrophysics* , HTS Teologiese Studies/Theological Studies (2017), ISSN: (Online) 2072-8050, (Print)

0259-9422.

• *How We Make Sense of Things: Information, Map-Making, and the Scientific Narrative*, in Map and Territory - Exploring the Foundations of Science, Thought and Reality, ed. by Shyam Wuppuluri, Newton da Costa, and Francisco Antonio Doria (Springer, Frontiers Collection, 2018).

Screenplays

• Co-author of *O Maior Amor do Mundo*, [The World's Greatest Love] with Brazilian director Cacá Diegues. The movie tells the story of a Brazilian astrophysicist that worked in the US most of his life and returns to Brazil in search of his roots. The movie was distributed by Columbia Pictures in September 2006. **Winner** in 2006 Paris and Montreal Film Festivals.

• Co-writer of *Trinity of Fire*, with David Glass. A major blockbuster with science as the main theme, as humanity fights civilization-threatening solar storms.

TV Documentaries and Series

• Participant in "God Only Knows", Equinox (1995), Channel 4, UK. Program focused on the Science-Religion debate.

• Key participant in episode 3 of "Stephen Hawking's Universe", BBC/PBS production, 1997.

• Participant in "Itineraries of Longing", an HBO production, February 2002. Documentary focuses on prominent Latin American's living in the US.

• Regular participant in the weekly television program "Globo Ciência", a production from TV FUTURA Brazil, dedicated to the dissemination of science for young adults (1997-2002).

• Participation in documentary for Chabot Space and Science Center, Oakland California, Winter 2005.

• Participation in Harvard/NASA educational video series for middle school teachers, 2006.

• Writer and presenter of a 12-part documentary series for TV Globo, Brazil, titled *Poeira das Estrelas* [Stardust]. The series, exhibited in the weekly news program *Fantástico* for 3 consecutive months (August-October 06), examined questions of "origins" from a scientific point of view, from the origin of the universe to the origin of life on Earth and other planets.

• Participation in "Beyond the Big Bang," a History Channel documentary, part of "The Universe" series, september 2007.

• Writer and anchor of a 10-part documentary series for TV Globo, Brazil, titled *Mundos Invisveis* [Invisible Worlds]. The series focused on the race to find the smallest constituents of matter, from the Greek atom to modern day particle physics. Series aired from Dec 07 to March 08.

• Participation in "How Life Began," a History Channel documentary, aired in summer 2008.

• Narrator of "How the Universe Works," an 8-part documentary series for Discovery Channel (Latin America), Fall 2010.

• Narrator of "The Known Universe," a 4-part documentary series for National Geographic Channel (Latin America), Winter 2012.

• Participation in "Through the Wormhole with Morgan Freeman", episode: *Is God an Alien Concept?*, March 5th, 2014, the Science Channel.

• Participation in "The Universe", episode: *Heavenly Destruction*, March 15th, 2014, History Channel.

• Participation in "Belief", an 8-part series produced and narrated by Oprah Winfrey.