



May 2002 – March 2007            Instructor  
Graduate School of Science, Department of Physics,  
Kyoto University, Kyoto, Japan

April 2000 – April 2002            Special Postdoctoral Researcher  
Mathematical Neuroscience Team, Brain Science Institute,  
RIKEN, Wako, Japan

April 1999 – March 2000            Postdoctoral Research Fellow  
Graduate School of Mathematical Sciences,  
University of Tokyo, Tokyo, Japan  
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Visiting positions

October 2007-September 2008    Visiting Researcher  
Department of Physical Chemistry,  
Fritz-Haber Institute of the Max-Planck Society, Berlin, Germany

June 2017-December 2017        Visiting Faculty  
Department of Mechanical Engineering,  
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**Memberships:**

Physical Society of Japan  
Institute of Electronics, Information, and Communication Engineers, Japan  
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**Research Areas:**

Nonlinear dynamics, stochastic processes, synchronization, pattern formation, chaos

**Recent Research Interests:**

Dimension-reduction theories for nonlinear dynamical system  
Self-organization in coupled dynamical systems  
Data-driven modeling of nonlinear systems  
Control, design, and optimization of dynamical systems

## Journal Editors:

2012-Present	Editorial Board, Progress of Theoretical and Experimental Physics Physical Society of Japan / Oxford University Press
2016-2017	Editorial Board, NOLTA (Nonlinear Theory and its Applications) Institute of Electronics, Information, and Communication Engineers, Japan
2018-Present	Editor, Physica D, Elsevier

## List of Publications:

### Journal articles (Publications in English only):

1. Timoteo Carletti and Hiroya Nakao, "Turing patterns in a network-reduced FitzHugh-Nagumo model", Phys. Rev. E 101, 022203 [12 pages] (2020)
2. Yuzuru Kato and Hiroya Nakao, "Semiclassical optimization of entrainment stability and phase coherence in weakly forced quantum limit-cycle oscillators", Phys. Rev. E 101, 012210 [9 pages] (2020)
3. Yoshiki Kuramoto and Hiroya Nakao, "On the Concept of Dynamical Reduction - The Case of Coupled Oscillators -", Philosophical Transactions of the Royal Society A 377: 20190041 (2019)
4. Yuzuru Kato, Naoki Yamamoto, and Hiroya Nakao, "Semiclassical phase reduction theory for quantum synchronization", Physical Review Research (American Physical Society) **1**, 033012 [15 pages] (2019)
5. Nobuhiro Watanabe, Yuzuru Kato, Sho Shirasaka, Hiroya Nakao, "Optimization of linear and nonlinear interaction schemes for stable synchronization of weakly coupled limit-cycle oscillators", Physical Review E **100**, 042205 [15 pages] (American Physical Society) (2019)
6. Ikuhiro Yamaguchi, Takuya Isomura, Hiroya Nakao, Yutaro Ogawa, Yasuhiko Jimbo, Kiyoshi Kotani, "Suppression of Macroscopic Oscillations in Mixed Populations of Active and Inactive Oscillators Coupled through Lattice Laplacian", Journal of the Physical Society of Japan, Vol. 88, 054004 [8 Pages] (2019).
7. Masanori Ouchi and Hiroya Nakao, "Modeling cochlear two-tone suppression using a system of nonlinear oscillators with feed-forward coupling", Nonlinear Theory and Its Applications, IEICE, **10**, 90–99 (2019).
8. Kunihiro Taira and Hiroya Nakao, "Phase-response analysis of synchronization for periodic flows", Journal of Fluid Mechanics (Cambridge University Press) **846**, R2 (2018).
9. Hiroya Nakao, Sho Yasui, Masashi Ota, Kensuke Arai, and Yoji Kawamura, "Phase reduction and synchronization of a network of coupled dynamical elements exhibiting collective oscillations", Chaos (American Institute of Physics) **28**, 045103 (2018) [J. L. Hudson focus issue].
10. Yoji Kawamura, Sho Shirasaka, Tatsuo Yanagita, and Hiroya Nakao, "Optimizing mutual synchronization of rhythmic spatiotemporal patterns in reaction-diffusion systems", Physical Review E (American Physical Society) **96**, 012224 (2017).
11. Sho Shirasaka, Nobuhiro Watanabe, Yoji Kawamura, and Hiroya Nakao, "Optimizing stability of mutual synchronization between a pair of limit-cycle oscillators with weak cross coupling", Physical Review E (American Physical Society) **96**, 012223 (2017).
12. Shigefumi Hata and Hiroya Nakao, "Localization of Laplacian eigenvectors on random networks", Scientific Reports (Nature Publishing Group) **7**, 1121 (2017).

13. Sho Shirasaka, Wataru Kurebayashi, and [Hiroya Nakao](#), "Phase-amplitude reduction of transient dynamics far from attractors for limit-cycling systems", *Chaos (American Institute of Physics)* **27**, 023119 [7 pages] (2017).
14. Sho Shirasaka, Wataru Kurebayashi, and [Hiroya Nakao](#), "Phase reduction theory for hybrid nonlinear oscillators", *Physical Review E (American Physical Society)* **95**, 012212 [15 pages] (2017).
15. Yoji Kawamura and [Hiroya Nakao](#), "Optimization of noise-induced synchronization of oscillator networks", *Physical Review E (American Physical Society)* **94**, 032201 [14 pages] (2016).
16. [Hiroya Nakao](#), "Phase reduction approach to synchronization of nonlinear oscillators", *Contemporary Physics (Taylor)* **57**, 188 [27 pages] (2016).
17. Wataru Kurebayashi, Sho Shirasaka, and [Hiroya Nakao](#), "A criterion for timescale decomposition of external inputs for generalized phase reduction of limit-cycle oscillators", *Nonlinear Theory and Its Applications (IEICE)* **6**, 171-180 (2015).
18. Yoji Kawamura and [Hiroya Nakao](#), "Phase description of oscillatory convection with a spatially translational mode", *Physica D (Elsevier)* **295-296**, 11-29 (2015).
19. Ikuhiro Yamaguchi, Yutaro Ogawa, [Hiroya Nakao](#), Yasuhiko Jimbo, and Kiyoshi Kotani, "Linear Analysis of the Corticothalamic Model with Time Delay", *Electronics and Communications in Japan* **97**, 32-44 (2014).
20. Wataru Kurebayashi, Tsubasa Ishii, Mikio Hasegawa and [Hiroya Nakao](#), "Design and control of noise-induced synchronization patterns", *EPL (European Physical Society)* **107**, 10009 [6 pages] (2014).
21. [Hiroya Nakao](#), "Complex Ginzburg-Landau equation on networks and its non-uniform dynamics", *European Physical Journal Special Topics (European Physical Society)* **223**, 2411-2421 (2014).
22. [Hiroya Nakao](#), Tatsuo Yanagita, and Yoji Kawamura, "Phase reduction approach to synchronization of spatiotemporal rhythms in reaction-diffusion systems", *Physical Review X (American Physical Society)* **4**, 021032 [23 pages] (2014).
23. Masahiro Kazama, Wataru Kurebayashi, Takahiro Tsuchida, Yuta Minoshima, Mikio Hasegawa, Koji Kimura, and [Hiroya Nakao](#), "Enhancement of noise correlation for noise-induced synchronization of limit-cycle oscillators by threshold filtering", *Nonlinear Theory and Its Applications (IEICE)* **5**, 157-171 (2014).
24. Shigefumi Hata, Hiroya Nakao, and Alexander S. Mikhailov, "Advection of passive particles over flow networks", *Physical Review E (American Physical Society)* **89**, 020801(R) [4 pages] (2014).
25. Yoji Kawamura and [Hiroya Nakao](#), "Noise-induced synchronization of oscillatory convection and its optimization", *Physical Review E (American Physical Society)* **89**, 012912 [13 pages] (2014).
26. Shigefumi Hata, [Hiroya Nakao](#), and Alexander S. Mikhailov, "Dispersal-induced destabilization of metapopulations and oscillatory Turing patterns in ecological networks", *Scientific Reports (Nature Publishing Group)* **4**, 3585 [9 pages] (2014).
27. Shigefumi Hata, [Hiroya Nakao](#), and Alexander S. Mikhailov, "Sufficient conditions for wave instability in three-component reaction-diffusion systems", *Progress of Theoretical and Experimental Physics (Japan Physical Society)*, 013A01 [17 pages] (2014).
28. Yoji Kawamura and [Hiroya Nakao](#), "Collective phase description of oscillatory convection", *Chaos (AIP Publishing)* **23**, 043129 [11 pages] (2013).

29. Wataru Kurebayashi, Sho Shirasaka, and [Hiroya Nakao](#), "Phase reduction method for strongly perturbed limit cycle oscillators", *Physical Review Letters (American Physical Society)* **111**, 214101 [5 pages] (2013).
30. Yu Atsumi, Shigefumi Hata, and [Hiroya Nakao](#), "Phase ordering in coupled noisy bistable systems on scale-free networks", *Physical Review E (American Physical Society)* **88**, 052806 [15 pages] (2013).
31. Kiyoshi Kotani, Ikuhiro Yamaguchi, Yutaro Ogawa, Yasuhiko Jimbo, [Hiroya Nakao](#), and G. Bard Ermentrout, "Adjoint method provides phase response functions for delay-induced oscillations", *Physical Review Letters (American Physical Society)* **109**, 044101 [5 pages] (2012).
32. Shigefumi Hata, [Hiroya Nakao](#), and Alexander S. Mikhailov, "Global feedback control of Turing patterns in network-organized activator-inhibitor systems", *Europhysics Letters (European Physical Society)* **98**, 64004 [6 pages] (2012).
33. Yu Atsumi and [Hiroya Nakao](#), "Persistent fluctuations in the synchronization rate in globally coupled oscillators with periodic external forcing", *Physical Review E (American Physical Society)* **85**, 056207 [12 pages] (2012).
34. Ikuhiro Yamaguchi, Yutaro Ogawa, Yasuhiko Jimbo, [Hiroya Nakao](#), and Kiyoshi Kotani, "Reduction Theories Elucidate the Origins of Complex Biological Rhythms Generated by Interacting Delay-Induced Oscillations", *PLoS ONE (Public Library of Science)* **6**, e26497 [10 pages] (2011).
35. Yoji Kawamura, [Hiroya Nakao](#), and Yoshiki Kuramoto, "Collective phase description of globally coupled excitable elements", *Physical Review E (American Physical Society)* **84**, 046211 [12 pages] (2011).
36. Shigefumi Hata, Kensuke Arai, Roberto F. Galán, and [Hiroya Nakao](#), "Optimal phase response curves for stochastic synchronization of limit-cycle oscillators by common Poisson noise", *Physical Review E (American Physical Society)* **84**, 016229 [10 pages] (2011).
37. Yoji Kawamura, [Hiroya Nakao](#), Kensuke Arai, Hiroshi Kori, and Yoshiki Kuramoto, "Phase synchronization between collective rhythms of globally coupled oscillator groups: Noiseless nonidentical case", *Chaos (American Institute of Physics)* **20**, 043109 [10 pages] (2010).
38. Yoji Kawamura, [Hiroya Nakao](#), Kensuke Arai, Hiroshi Kori, and Yoshiki Kuramoto, "Phase synchronization between collective rhythms of globally coupled oscillator groups: Noisy identical case", *Chaos (American Institute of Physics)* **20**, 043110 [8 pages] (2010).
39. Denis S. Goldobin, Jun-nosuke Teramae, [Hiroya Nakao](#), and G. Bard Ermentrout, "Dynamics of limit cycle oscillators subject to general noise", *Physical Review Letters (American Physical Society)* **105**, 154101 [4 pages] (2010).
40. [Hiroya Nakao](#), Jun-nosuke Teramae, Denis S. Goldobin, and Yoshiki Kuramoto, "Effective long-time phase dynamics of limit-cycle oscillators driven by weak colored noise", *Chaos (American Institute of Physics)* **20**, 033126 [10 pages] (2010).
41. Shigefumi Hata, Takeaki Shimokawa, Kensuke Arai, and [Hiroya Nakao](#), "Synchronization of uncoupled oscillators by common gamma impulses: from phase locking to noise-induced synchronization", *Physical Review E (American Physical Society)* **82**, 036206 [12 pages] (2010).
42. [Hiroya Nakao](#) and Alexander S. Mikhailov, "Turing patterns in network-organized activator-inhibitor systems", *Nature Physics (Nature Publishing Group)* **6**, 544-550 (2010).
43. Hisa-Aki Tanaka, [Hiroya Nakao](#), and Kenta Shinohara, "Self-organizing timing allocation mechanism in distributed wireless sensor networks", *IEICE Electronic Express (Institute of Electronics, Information and Communication Engineers)* **6**, 1562-1568 (2009).

44. Hiroshi Kori, Yoji Kawamura, [Hiroya Nakao](#), Kensuke Arai, and Yoshiki Kuramoto, "Collective dynamical response of coupled oscillators with general network structure", *Physical Review E (American Physical Society)* **80**, 036207 [9 pages] (2009).
45. Jun-nosuke Teramae, [Hiroya Nakao](#), and G. Bard Ermentrout, "Stochastic phase reduction for a general class of noisy limit cycle oscillators", *Physical Review Letters (American Physical Society)* **102**, 194102 [4 pages] (2009).
46. [Hiroya Nakao](#) and Alexander S. Mikhailov, "Diffusion-induced instability and chaos in random oscillator networks", *Physical Review E (American Physical Society)* **79**, 036214 [5 pages] (2009).
47. Ken Nagai and [Hiroya Nakao](#), "Experimental synchronization of circuit oscillations induced by common telegraph noise", *Physical Review E (American Physical Society)* **79**, 036205 [6 pages] (2009).
48. Kensuke Arai and [Hiroya Nakao](#), "Averaging approach to phase coherence of uncoupled limit-cycle oscillators receiving common random impulses", *Physical Review E (American Physical Society)* **78**, 066220 [8 pages] (2008).
49. Yoji Kawamura, [Hiroya Nakao](#), Kensuke Arai, Hiroshi Kori, and Yoshiki Kuramoto, "Collective phase sensitivity", *Physical Review Letters (American Physical Society)* **101**, 024101 [4 pages] (2008).
50. Kensuke Arai and [Hiroya Nakao](#), "Phase coherence in an ensemble of uncoupled limit-cycle oscillators receiving common Poisson impulses", *Physical Review E (American Physical Society)* **77**, 036218 [17 pages] (2008).
51. [Hiroya Nakao](#), Kensuke Arai, and Yoji Kawamura, "Noise-induced synchronization and clustering in ensembles of uncoupled limit-cycle oscillators", *Physical Review Letters (American Physical Society)* **98**, 184101 [4 pages] (2007).
52. Yoji Kawamura, [Hiroya Nakao](#), and Yoshiki Kuramoto, "Noise-induced turbulence in nonlocally coupled oscillators", *Physical Review E (American Physical Society)* **75**, 036209 [17 pages] (2007).
53. [Hiroya Nakao](#), Shuya Kitada, and Alexander S. Mikhailov, "Universal finite-sample effect on the perturbation growth in chaotic dynamical systems", *Physical Review E (American Physical Society)* **74**, 026213 [10 pages] (2006).
54. [Hiroya Nakao](#), Ken Nagai, and Kensuke Arai, "Reproducibility of a noisy limit-cycle oscillator induced by a fluctuating input", *Progress of Theoretical Physics Supplement (Physical Society of Japan)* **161**, 294-297 (2006).
55. [Hiroya Nakao](#), "Population coding by globally coupled phase oscillators", *Journal of the Physical Society of Japan (Physical Society of Japan)* **75**, 034001 [7 pages] (2006).
56. [Hiroya Nakao](#), Kensuke Arai, Ken Nagai, Yasuhiro Tsubo, and Yoshiki Kuramoto, "Synchrony of limit-cycle oscillators induced by random external impulses", *Physical Review E (American Physical Society)* **72**, 026220 [13 pages] (2005).
57. Hirokazu Asano and [Hiroya Nakao](#), "Independent component analysis of spatiotemporal chaos", *Journal of the Physical Society of Japan (Physical Society of Japan)* **74**, 1661-1665 (2005).
58. Ken Nagai, [Hiroya Nakao](#), and Yasuhiro Tsubo, "Synchrony of neural Oscillators induced by random telegraphic currents", *Physical Review E (American Physical Society)* **71**, 036217 [8 pages] (2005).
59. [Hiroya Nakao](#) and Alexander S. Mikhailov, "Statistics of rare strong bursts in autocatalytic stochastic growth with diffusion", *Chaos (American Institute of Physics)* **13**, 953-961 (2003).

60. Hiroya Nakao, Tsuyoshi Mishiro, and Michio Yamada, “Visualization of correlation cascade in spatio-temporal chaos using wavelets”, *International Journal of Bifurcation and Chaos (World Scientific)* **11**, 1483-1493 (2001).
61. Hiroya Nakao, “Multi-scaling properties of truncated Lévy flights”, *Physics Letters A (Elsevier)* **266**, 282-289 (2000).
62. Yoshiki Kuramoto, Hiroya Nakao, and Dorjsuren Battogtokh, “Multi-scaled turbulence in large populations of oscillators in a diffusive medium”, *Physica A (Elsevier)* **288**, 244-264 (2000).
63. Hiroya Nakao, “Anomalous spatio-temporal chaos in a two-dimensional system of non-locally coupled oscillators”, *Chaos (American Institute of Physics)* **9**, 902-909 (1999).
64. Hiroya Nakao and Yoshiki Kuramoto, “Multi-affinity and multi-fractality in systems of chaotic elements with long-wave forcing”, *European Physical Journal B (EDP Sciences)* **11**, 345-360 (1999).
65. Yoshiki Kuramoto, Dorjsuren Battogtokh, and Hiroya Nakao, “Multiaffine Chemical Turbulence”, *Physical Review Letters (American Physical Society)* **81**, 3543-3546 (1998).
66. Hiroya Nakao, “Asymptotic power law of moments in a random multiplicative process with weak additive noise”, *Physical Review E (American Physical Society)* **58**, 1591-1600 (1998).
67. Yoshiki Kuramoto and Hiroya Nakao, “Power-Law Spatial Correlations and the Onset of Individual Motions in Self-Oscillatory Media with Non-Local Coupling”, *Physica D (Elsevier)* **103**, 294-313 (1997).
68. Yoshiki Kuramoto and Hiroya Nakao, “Scaling Properties in Large Assemblies of Simple Dynamical Units Driven by Long-Wave Random Forcing”, *Physical Review Letters (American Physical Society)* **78**, 4039-4042 (1997).
69. Yoshiki Kuramoto and Hiroya Nakao, “Origin of Power-Law Spatial Correlations in Distributed Oscillators and Maps with Nonlocal Coupling”, *Physical Review Letters* **76**, 4352-4355 (1996).

Submitted:

1. Yuzuru Kato and Hiroya Nakao, “Quantum coherence resonance”, submitted to *Physical Review Research* (2019).
2. Kiyoshi Kotani et al., “Nonlinear phase-amplitude reduction of delay-induced oscillations”, submitted to *Physical Review Research* (2020).
3. Hiroya Nakao and Igor Mezić, “Spectral Analysis of the Koopman Operator for Partial Differential Equations”, submitted to *Chaos* (2020).

Conference proceedings:

1. Yuzuru Kato and Hiroya Nakao, "Optimal Waveform for Fast Entrainment of Weakly Forced Quantum Nonlinear Dissipative Oscillators", *Proceedings of the 58nd IEEE Conference on Decision and Control, Nice, France, December 2019*, 1351-1356 (2019).
2. Hiroya Nakao and Igor Mezić, Koopman eigenfunctionals and phase-amplitude reduction of rhythmic reaction-diffusion systems, *Proceedings of the SICE Annual Conference 2018 September 11-14, 2018, Nara, Japan*, p.74-77 (2018).
3. Wataru Kurebayashi, Sho Shirasaka and Hiroya Nakao, “Optimal Model Selection for Estimating Stochastic Koopman Modes”, *Proceedings of 2017 International Symposium on Nonlinear Theory and its Applications (NOLTA2017)*, p. 12 (2017).

4. Wataru Kurebayashi, Sho Shirasaka and Hiroya Nakao, “Phase Reduction Theory for Strongly Coupled Limit-Cycle Oscillators”, Proceedings of 2017 International Symposium on Nonlinear Theory and its Applications (NOLTA2017), p. 342 (2017).
5. Wataru Kurebayashi, Sho Shirasaka, and Hiroya Nakao, “Optimal Parameter Selection for Kernel Dynamic Mode Decomposition”, Proceedings of 2016 International Symposium on Nonlinear Theory and Its Applications NOLTA 2016, Yugawara, Japan, November 27th-30th, 2016, 370-373.
6. Masashi Ota, Sho Yasui, Sho Shirasaka, and Hiroya Nakao, “Stability and sensitivity of synchronized states in a network of symmetrically coupled nonlinear oscillators for generating gait patterns”, Proceedings of 2015 International Symposium on Nonlinear Theory and its Applications NOLTA2015, Kowloon, Hong Kong, China, December 1-4, 2015, 664-667.
7. Sho Shirasaka, Wataru Kurebayashi, and Hiroya Nakao, “Uncontrolled manifold analysis of oscillatory motions in dynamical models of body movement based on the Floquet theory”, Proceedings of 2015 International Symposium on Nonlinear Theory and its Applications NOLTA2015, Kowloon, Hong Kong, China, December 1-4, 2015, 668-671.
8. Ken Nishikawa, Wataru Kurebayashi, and Hiroya Nakao, “Bayesian Parameter Estimation of Non-stationary Collective Dynamics in Moving Animal Groups”, Proceedings of 2014 International Symposium on Nonlinear Theory and its Applications, Luzern, Switzerland, 882-885 (2014).
9. Wataru Kurebayashi, Sho Shirasaka, and Hiroya Nakao, “Synchronization Analysis of Nonlinear Oscillators by a Quadratic Phase Model”, Proceedings of 2014 International Symposium on Nonlinear Theory and its Applications, Luzern, Switzerland, 874-877 (2014).
10. Wataru Kurebayashi, Kantaro Fujiwara, Hiroya Nakao, and Tohru Ikeguchi, "A Theory on Noise-Induced Synchronization of Chaotic Oscillators", Proceedings of 2012 International Symposium on Nonlinear Theory and its Applications, Palma, Majorca, Spain, 344-347 (2012).
11. Ikuhiro Yamaguchi, Yutaro Ogawa, Hiroya Nakao, Yasuhiko Jimbo, and Kiyoshi Kotani, “Ginzburg-Landau Equations Reduced from Coupled Delay Differential Equations”, Proceedings of 2012 International Symposium on Nonlinear Theory and its Applications, Palma, Majorca, Spain, 915-918 (2012).
12. Hiroya Nakao, Tatsuo Yanagita, and Yoji Kawamura, “Phase description of stable limit-cycle solutions in reaction-diffusion systems”, Procedia IUTAM, vol. 5, 227-233, 2012.
13. Shigefumi Hata and Hiroya Nakao, “Optimal phase response curves for stochastic synchronization and desynchronization of limit-cycle oscillators”, Proceedings of 2011 International Symposium on Nonlinear Theory and its Applications, Kobe, Japan, 100-103 (2011).
14. Kensuke Arai and Hiroya Nakao, “The analysis of phase coherence of an ensemble of uncoupled limit-cycle oscillators via averaging of a jump-diffusion Kolmogorov equation”, Proceedings of 2007 International Symposium on Nonlinear Theory and its Applications, Vancouver, Canada, 100-103 (2007).
15. Kensuke Arai and Hiroya Nakao, “Reproducibility of limit-cycle oscillators induced by random impulses”, Proceedings of 2006 International Symposium on Nonlinear Theory and its Applications, Bologna, Italy, 295-298 (2006).

Book chapters:

1. S Shirasaka, W Kurebayashi, and H Nakao, “Phase-Amplitude Reduction of Limit Cycling Systems”, In: Mauroy A., Mezić I., Susuki Y. (eds) The Koopman Operator in Systems and Control. Lecture Notes in Control and Information Sciences, vol 484. Springer, Cham, 2020/2.

Edited volumes:

1. Shigeru Shinomoto, Hiroya Nakao, Takao Ohta, and Yoshiki Kuramoto, “Oscillation, Chaos and Network Dynamics in Nonlinear Science - Proceedings of the International Symposium on Nonlinear Oscillations -“, Progress of Theoretical Physics Supplement (Physical Society of Japan) **161** (2006).