

# James M. Kunert-Graf

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- CONTACT            jkunert@pnri.org  
                      james.kunertgraf.com
- RESEARCH            • Nonlinear Networked Dynamical Systems, and Complex Networks More Broadly  
INTERESTS           • Data Science for Computational Neuroscience and Biomedical Data: Machine Learning,  
                          Dimensionality Reduction, and Equation-Free Modeling  
                          • Information Theory for Inference of Non-Pairwise Multivariable Dependency
- RESEARCH            **Pacific Northwest Research Institute**, Seattle WA            July 2016-Present  
EXPERIENCE           Postdoctoral Research Fellow
- University of Washington**            Spring 2012-Spring 2016  
                          Graduate Research Assistant  
                          Project: Dynamical Modeling of *C. elegans* Connectome  
                          Advisor: J. Nathan Kutz (Applied Math)
- Institute for Disease Modeling**            Summer 2015  
                          Visiting Researcher  
                          Project: Applications of Dynamic Mode Decomposition to Networked Systems  
                          Supervisor: Josh Proctor (Applied Math Division)
- California Institute of Technology**            Summer 2010  
                          Summer Research Internship at L.I.G.O.  
                          Project: Properties of Hartmann Sensor for Thermal Compensation Subsystem  
                          Advisors: Aidan Brooks and Phil Willems (Physics)
- University of Oregon**            Fall 2009 to Spring 2011  
                          Undergraduate Researcher  
                          Project: Low-Temperature Electrical Properties of Ferecrystals  
                          Advisor: David Johnson (Chemistry)
- EDUCATION            **University of Washington**, Seattle WA  
                          Ph.D. in Physics, June 2016
- Advisor: J. Nathan Kutz (Applied Mathematics)  
                          • Thesis: *Functionality, Robustness and Control of Nonlinear Network Dynamics: Modeling and Understanding the C. elegans Connectome*
- University of Oregon**, Eugene OR  
                          B.S. in Physics and Mathematics (applied track), Spring 2011
- Graduated Summa Cum Laude with Departmental Honors
- JOURNAL            7. **JM Kunert-Graf**, E Shlizerman, A Walker, JN Kutz. “Multistability and Long-  
PUBLICATIONS       Timescale Transients Encoded by Network Structure in a Model of *C. elegans*  
                          Connectome Dynamics.” *Frontiers in Computational Neuroscience* **11** (2017).
6. DJ Galas, G Dewey, **J Kunert-Graf**, NA Sakhanenko. “Expansion of the  
                          Kullback-Leibler Divergence, and a new class of information metrics.” *Axioms*  
                          **6(2)**, 8 (2017).
5. **JM Kunert-Graf**, NA Sakhanenko, DJ Galas. “Complexity and Vulnerability  
                          Analysis of the *C. elegans* Gap Junction Connectome.” *Entropy* **19(3)**, 104  
                          (2017).
4. **JM Kunert**, JL Proctor, SL Brunton, JN Kutz. “Spatiotemporal Feedback and  
                          Network Structure Drive and Encode Caenorhabditis elegans Locomotion.” *PLOS  
                          Computational Biology* **13(1)**, e1005303 (2017).

3. **JM Kunert**, PD Maia, JN Kutz. "Functionality and Robustness of Injured Connectomic Dynamics in *C. elegans*: Linking Behavioral Deficits to Neural Circuit Damage." *PLOS Computational Biology* **13(1)**, e1005261 (2017).
2. M Beekman, G Rodriguez, R Atkins **J Kunert**, DB Moore, DC Johnson. "Detection of nanoscale embedded layers using laboratory specular X-ray diffraction." *Journal of Applied Physics* **117**, 185305 (2015).
1. **J Kunert**, E Shlizerman, JN Kutz. "Low-dimensional functionality of complex network dynamics: Neurosensory integration in the *Caenorhabditis elegans* connectome." *Physical Review E* **89**, 052805 (2014).

#### INVITED TALKS

1. **JM Kunert-Graf**, "Dynamic Mode Decomposition Reveals Low-Dimensional Structure and a Hierarchy of Timescales in *C. elegans* Neural Dynamics," BIRS Workshop 17w5140 "Data-Driven Methods for Reduced-Order Modeling and Stochastic Partial Differential Equations", BIRS, Banff, CA

#### CONTRIBUTED TALKS

5. **JM Kunert-Graf**, "Spatiotemporal Feedback and Network Structure Drive and Encode *Caenorhabditis elegans* Locomotion", SIAM Dynamical Systems 2017, Snowbird, UT, USA

#### CONTRIBUTED POSTERS

1. **JM Kunert**, E Shlizerman, and JN Kutz, "Identifying Proxies for Behavior in full-network *C. elegans* neural simulations". Computational Systems and Neuroscience (COSYNE) 2015, Salt Lake City
2. **JM Kunert**, E Shlizerman, and JN Kutz, "Low-Dimensional Functionality of Connectome Dynamics: Neuro-sensory integration in *C. elegans*". Computational Systems and Neuroscience (COSYNE) 2014, Salt Lake City
3. **JM Kunert**, E Shlizerman, and JN Kutz, "Low-Dimensional Functionality of Connectome Dynamics in *C. elegans*". Data Science at the UW A Campus Conversation 2014, Seattle
4. **JM Kunert**, E Shlizerman, and JN Kutz, "Full Network Dynamics of the *C. elegans* Connectome". Biomedical Engineering Society Annual Meeting (BMES) 2013, Seattle
5. **JM Kunert**, E Shlizerman, and JN Kutz, "Investigating dynamical properties of the *C. elegans* Connectome through full-network simulations". Organization for Computational Neuroscience Annual Meeting (CNS) 2013, Paris

#### TEACHING EXPERIENCE

##### University of Washington

Teaching Assistant

2011 to 2015

*Partial List of Assignments:*

- PHYS 121/2/3 - Introductory Physics Labs and Tutorial Sections (2011 to 2015)
- PHYS 216 - Science and Society (Spring 2013)
- PHYS 334 - Electric Circuits Laboratory (Winter 2015)
- PHYS 432 - Modern Physics Laboratory (Spring 2014)
- PHYS 434 - Application of Computers to Physical Measurement (Fall 2012)
- PHYS 441 - Quantum Physics (Fall 2013)
- PHYS 513 - Electromagnetism and Relativity (Fall 2012)