

ACADEMIC CURRICULUM VITAE

Dr. rer. nat. Aicko Yves Schumann

Last update: August 2018

Citizenship: Germany

Residency A: U.S. Permanent Resident („Greencard“)

Residency B: Permanent Resident of Canada („Whitecard“)

Contact Information

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Present Academic Positions

Research Assistant Professor

Physicist, Center Statistician, Big Data Scientist

Institute of Psychiatry and Behavioural Science

Medical University of South Carolina

67 President Street (Rm. 506C)

Charleston, S.C. 29425, United States

Office Phone: +1 843-792-6470 (daytime)

Adjunct Professor for Physics

The Citadel – Military College of South Carolina

171 Moultrie Street (Grimsley Hall, Rm. 222)

Charleston, S.C. 29409, United States

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Academic Degrees

May 2010 **Ph.D. in Physics** with overall result *summa cum laude*

subm. 2009 Computational Nanoscience Group, Martin-Luther Univ. Halle-Wittenberg, Germany

Ph.D. thesis: “Fluctuations and Synchronization in Complex Physiological Systems”

Developed novel multivariate time series- and dynamic functional network analysis methods to study interdependent fluctuations and oscillations in physiological (big) data. Studied 1/f- and stochastic noise in persistent and long-range correlated time series. Established new statistical measures for cardiac risk and designed novel disease classifiers based on time series recorded during sleep.

Jan 2004 **M.Sc. in Physics** (German Diplom Physiker), with overall result *“very good”*

subm. 2003 Nonlinear Dynamics Group, University of Potsdam, Germany

Final exams in Theoretical Physics – *Advanced Quantum Mechanics* and *Statistical Physics*, Experimental Physics – *Solid State Physics*, Mathematics – *Group Theory*, and *Nonlinear Dynamics*

Diploma thesis: “Wavelet Analysis of Sediment Data With Respect to nonlinear Age-Depth-Models” (original title in German: “Waveletanalyse von Sedimentdaten unter Einbeziehung von nichtlinearen Alters-Tiefen-Modellen”)

Developed a statistical approach to study irregularly sampled climate-proxy data and time series of magnetic susceptibility in sediment cores using wavelet analysis.

Mar 2002 **B.Sc. in Physics** (German Vordiplom), with overall result *“very good”*,

University of Potsdam, Germany

Final exams in Theoretical Physics, Experimental Physics, Mathematics, Chemistry

Ph.D. Awards

- Dec 2010 Publication Award within “Excellence Initiative of Logos Verlag Berlin” for Ph.D. with distinction, Germany-wide competition
- Jul 2010 Martin Luther Award for Ph.D. with distinction, State of Saxony Anhalt, Germany

Professional Posts and Academic Training

- 2017-pres. **Associate Faculty of the College of Graduate Studies**, Institute for Psychiatry and Behavioural Science, Medical University of South Carolina, Charleston, S.C., U.S.A.
Qualifies Faculty to serve on examination committees at MUSC (MD and Ph.D. programs)
- 2016-pres. **Research Assistant Professor & Center Statistician**, Institute for Psychiatry and Behavioural Science, Medical University of South Carolina, Charleston, S.C., U.S.A.
Research: Dynamical Brain Networks (Healthy vs. Psychiatric Disorders), Olfaction in PTSD, Statistics & Biostatistics Methodology for Biomedical Large Data (fMRI Imaging and Electrophysiology)
- 2016-pres. **Adjunct Professor for Physics**, The Citadel, Military College of South Carolina, Charleston, S.C., U.S.A.
Teaching: Algebra- and Calculus-based Introductory Physics, College Physics Laboratories (PHYS203, PHYS204, PHYS253, PHYS254, PHYS271, PHYS272).
- 2015 **Postdoctoral Researcher – Bioinformatics / Computational Neuroscience**, Medical University of South Carolina, Charleston, S.C., U.S.A.
Research: Brain dynamics and networks based on MRI/fMRI data, 3D computer vision, machine learning (deep learning, neural networks), multivariate regression analysis, noise models, computer-aided classification; computational physics model for cortical sheet/layers folding; Focus: Visual Imagery
- 2013-2014 **Postdoctoral Researcher – Image-Data Analytics & Pattern Recognition**, Canadian Centre for Behavioural Neuroscience and AIHS Polaris Group for Neuroscience, Department of Neuroscience, University of Lethbridge, Canada
Research: Mouse and rat brain connectomes, neural circuits, information processing and encoding in the brain, hippocampal memory function; single unit electrophysiology using tetrodes, optical brain imaging– Ca^{2+} imaging, two-photon microscopy, voltage-sensitive dye imaging; imaging-data processing, pattern recognition, wave propagation
- 2010-2014 **Scientific Consultant – Avatar EEG Solutions Inc.**, Calgary Alberta, Canada
Software and Technology Startup; in 2014 acquired by EGI Inc. Eugene, OR
Research: EEG data analysis, noise mitigation, signal processing, firmware/embedded programming EFM32 ARM Cortex M3, quality control
Represented the Canadian Province of Alberta and Avatar EEG Solutions Inc. on Economic Trade Mission to Germany in 2013.
- 2010-2013 **Postdoctoral Fellow, Complexity Science Group**, Department of Physics and Astronomy, University of Calgary, Canada
Research: Extreme value statistics in persistent α -stable processes with applications in human physiology; analysis of dynamical functional brain networks (weighted and directed graphs) in noisy coupled chaotic oscillator models and in multivariate sleep data; stochastic earthquake simulations (epidemic-type aftershock sequences)
- 2008 **Visiting Scientist**, Department for Physics, Bar Ilan University, Ramat Gan, Israel
Research: Functional physiological networks during sleep, cardiorespiratory phase synchronization in human movement disorders & Parkinson’s disease
- 2005-2009 **Staff Scientist & Ph.D. Student, Computational Nanoscience Group**, Department of Physics, Martin-Luther University Halle-Wittenberg and Justus Liebig University Gießen, Germany (Public Defense May 2010)
Research: Stochastic models, Brownian motion and correlated noise models, surrogate data, statistics and hypothesis testing, multivariate data analysis in medicine; dynamical (physiological) functional networks; big data analysis method development; training in financial mathematics
- 2004-2005 **Visiting Scientist**, Max-Planck-Institute for Colloids and Interfaces Golm and Institute of Mathematics at University of Potsdam

- Research: Light scattering, inverse ill-posed problems, ellipsometry in thin films, LIDAR (light detection and ranging) for studying aerosols in atmospheric research
- 2004 **Visiting Scientist, Institute for Nonlinear Science**, University of California, San Diego (UCSD), U.S.A.
Research: Synchronization of coupled chaotic systems and partial differential equations (PDE); application to data-driven weather prediction, Lyapunov- and Bred-vectors for dimension reduction and capturing of fast-growing dynamical instabilities
- 1998-2003 **Undergraduate and Graduate Studies in Physics** (B.Sc. and M.Sc.), Nonlinear Dynamics Group, Department of Physics, University of Potsdam, Germany (Public Defense Jan. 2004)
- 1997-1999 **Undergraduate Studies in Geoecology** (up to *Vordiplom*, B.Sc. level), University of Potsdam, Germany

Graduate Scholarships

- 2006-2009 Scholarship of the European Union within the European Union project DAPHNET (*“Dynamical Analysis of Physiological Networks”*)
- 2005-2009 Scholarship of the German Research Foundation (proposal title: *“Diagnostic Time Series Analysis of Heartbeat and Respiration in Parkinson patients, sleep disorders, and cardiac arrhythmia in comparison with healthy controls”*; original title in German: *“Diagnostische Zeitreihenanalyse von Herzschlag und Atmung bei Parkinson, Schlafstörungen und Herzrhythmusstörungen im Vergleich zu Gesunden”*)
- 2004 Scholarship of the Institute for Nonlinear Science (INLS), University of California San Diego (UCSD), U.S.A.
- 2003-2004 Scholarship of the Arbeitsgruppe Nonlinear Dynamics, Department of Physics, University of Potsdam to pursue Diploma thesis titled *“Wavelet Analysis of Sediment Data With Respect to Age-Depth-Models”*

List of Publications

Books

1. **A. Y. Schumann** *Fluctuations and Synchronization in Complex Physiological Systems*, Logos Verlag Berlin, ISBN 978-3-8325-2756-3, pp. 245, 2011

Journals and Proceedings (peer-reviewed)

* indicates supervised student co-authors working on B.Sc., M.Sc., Ph.D., or MD (see Mentorship activity)

† indicates shared first authorship

Work in Progress / In Preparation

31. **A. Y. Schumann**, M. B. Cortese, and T. Uhde, *Dynamical brain connectivity changes due to psychiatric disorders*, present focus, to be submitted 2018
30. **A. Y. Schumann** and M. H. Mohajerani, *Evoked-Like Pattern Formation in Spontaneous Cortical Activity*, to be submitted 2018/2019
29. **A. Y. Schumann**, J. Kranz*, and J. Davidsen, *Statistics of extreme values and return intervals in pathologic heartbeat data; currently orphaned*
28. **A. Y. Schumann** and J. Davidsen *Event-based stochastic deposition processes and their application to precipitation*, JStatMech or EPL; HPC simulations completed; **orphaned**

Under Revision

27. G. L. Sahlem, T. W. Uhde, A. K. Wilkerson; **A. Y. Schumann**, S. Ancoli-Israel, *Effects of Dawn Simulation in First Year Medical Students: A Pilot Randomized Controlled Trial*, Sleep Health: Journal of the National Sleep Foundation; submitted
26. K. Fuchs*, **A. Y. Schumann**, J. W. Kantelhardt, D. Buck, and T. Penzel, *Effects of respiration and sleep stages on human baroreflex sensitivity*, (original work from 2012, additional experiments from medical partners required after initial review), **contrib. 50%, 18 pages draft**

Published - Peer Reviewed

25. M. B. Cortese, **A. Y. Schumann**, A. N. Howell^{*}, Patrick McConnell^{*}, Qing Yang, T. W. Uhde *Preliminary evidence for differential olfactory and trigeminal processing in combat veterans with and without PTSD*, NeuroImage: Clinical 17 (2018), 378-387. <http://doi.org/10.1016/j.nicl.2017.09.018>, **contrib. 40%**.
24. A. K. Wilkerson, T. W. Uhde, K. Leslie, W. C. Freeman, S. D. LaRowe, **A. Y. Schumann**, and B. M. Cortese *Paradoxical olfactory function in combat Veterans: The role of PTSD and odor factors*, Military Psychology 30(2) (2018), 120-130, doi = 10.1080/08995605.2018.1425063, **contrib. 25%**.
23. M. B. Cortese, **A. Y. Schumann**, T. W. Uhde *Accelerated Neurodegeneration: Effects of Cumulative Trauma Exposure and Chronic Posttraumatic Stress Disorder (PTSD) in Relatively Young Combat Veterans*, Biological Psychiatry 81(10) (2017), S233, doi: 10.1016/j.biopsych.2017.02.446, **contrib. 33%**.
22. A. Kuhnhold^{*}, **A. Y. Schumann**, R. P. Bartsch, R. Ubrich, P. Barthel, G. Schmidt, J. W. Kantelhardt *Quantifying cardio-respiratory phase synchronisation - a comparison of five methods using ECGs of post-infarction patients*, Physiol. Meas. 38(5) (2017), 925-939, doi: 10.1088/1361-6579/aa5dd3, **contrib. 33%**.
21. J. W. Kantelhardt, S. Tismer^{*}, F. Gans^{*}, **A. Y. Schumann** and T. Penzel *Scaling behavior of EEG amplitude and frequency time series across sleep stages*, Europhys. Lett. 112 (2015), 18001, doi: 10.1209/0295-5075/112/18001, **contrib. 30%, 6 pages**
20. J. Davidsen[†], **A. Y. Schumann**, M. Naylor, *Are scale-invariant stress orientations related to seismicity rates near the San Andreas fault?*, Geophys. Res. Lett. 40, doi:10.1002/2013GL057919 (2013), **contrib. 50%**
19. P. Wohlfahrt^{*}, J. W. Kantelhardt, M. Zinkhan, **A. Y. Schumann**, T. Penzel, F. Pillmann, and A. Stang, *Transitions in scaling behaviour of accelerometric time series across sleep and wake*, Europhys. Lett. EPL 103(6) 68002 (2013), **contrib. 33%, 6 pages**
18. C. Gu^{*}, **A. Y. Schumann**, M. Baiesi, and J. Davidsen, *Triggering cascades and statistical properties of aftershocks*, J. Geophys. Research - Solid Earth 118(8), 4278-4295 (2013), **contrib. 33%, 17 pages**
17. R. P. Bartsch, **A. Y. Schumann**, J. W. Kantelhardt, T. Penzel, and P. Ch. Ivanov, *Phase Transitions in Physiologic Coupling*, PNAS 109(26), 10181-10186 (2012), doi: 10.1073/pnas.1204568109, **contrib. 40%, 6 pages**
16. **A. Y. Schumann**, N. R. Moloney, and J. Davidsen, *Extreme value and record statistics in heavy-tailed processes with long-range memory*, In A. S. Sharma, A. Bunde, V. P. Dimri, D. N. Baker (eds.), Geophysical Monograph Series Vol. 196: *Extreme Events and Natural Hazards: The Complexity Perspective.*, pp. 315-334, American Geophysical Union, Washington, DC, 2012, <http://dx.doi.org/10.1029/GM196>, ISBN 978-0-87590-486-3; **contrib. 80%, 19 pages**
15. **A. Y. Schumann** and J. W. Kantelhardt, *Multifractal modelling with tuned correlations and multifractal analysis with centered moving averages*, Physica A 390(14), 2637-2654 (2011), doi: 10.1016/j.physa.2011.03.002, **contrib. 90%, 18 pages**
14. J. Ludescher, M. I. Bogachev, J. W. Kantelhardt, **A. Y. Schumann**, and A. Bunde, *On spurious and corrupted multifractality: The effects of additive noise, short-term memory and periodic trends* Physica A 390(13), 2480-2490 (2011), doi: 10.1016/j.physa.2011.03.008, **contrib. 20%, 11 pages**
13. **A. Y. Schumann**, R. P. Bartsch, P. Ch. Ivanov, T. Penzel, and J. W. Kantelhardt, *Aging effects on cardiac and respiratory dynamics in healthy subjects across sleep stages*, Sleep 33(7), 943-955 (2010), **contrib. 80%, 13 pages**
12. J. W. Kantelhardt, F. Gans^{*}, **A. Y. Schumann**, and T. Penzel *EEG Cross modulation during sleep and wake*, Proc. Int. Biosignal Processing Conf., Berlin Germany, 002 (2010), **contrib. 33%, 4 pages**
11. A. Kuhnhold^{*}, **A. Y. Schumann**, R. P. Bartsch, G. Schmidt, and J. W. Kantelhardt *Cardio-respiratory phase synchronization from reconstructed respiration*, Proc. Int. Biosignal Processing Conf., Berlin, Germany, 076 (2010), **contrib. 50%, 4 pages**
10. **A. Y. Schumann**, A. Kuhnhold^{*}, R. P. Bartsch, K. Fuchs^{*}, A. Bauer, G. Schmidt, and J. W. Kantelhardt, *Reconstructed respiration and cardio-respiratory phase synchronization in post-infarction patients*, Proc. 6th Conference of the European Study Group on Cardiovascular Oscillations, Berlin, Germany, 053 (2010), **contrib. 70%, 4 pages**
9. K. Fuchs^{*}, **A. Y. Schumann**, A. Kuhnhold^{*}, P. Guzik, J. Piskorski, G. Schmidt, and J. W. Kantelhardt, *Comparing analysis of heart rate and blood pressure fluctuations in healthy subjects*, Proc. 6th Conference of the European Study Group on Cardiovascular Oscillations, Berlin, Germany, 056 (2010), **contrib. 60%, 4 pages**

8. K. Stumpf^{*}, **A. Y. Schumann**, M. Plotnik, F. Gans^{*}, T. Penzel, I. Fietze, J. M. Hausdorff, and J. W. Kantelhardt, *Effects of Parkinson's disease on brain-wave phase synchronisation and cross-modulation*, Europhys. Lett. **89**(4), 48001 (2010), **contrib. 60%, 6 pages**
7. T. Penzel, **A. Y. Schumann**, R. P. Bartsch, P. C. Ivanov, and J. W. Kantelhardt, *Altersabhängigkeit der Herzfrequenzschwankungen in den verschiedenen Schlafstadien bei gesunden Probanden*, Pneumologie **64**(10), A25 (2010)
6. F. Gans^{*}, **A. Y. Schumann**, J. W. Kantelhardt, T. Penzel, and I. Fietze, *Cross-modulated amplitudes and frequencies characterize interacting components in complex systems*, Phys. Rev. Lett. **102**, 098701 (2009), **contrib. 60%, 4 pages + 8 pages supplement**
5. C. Hamann^{*}, R. P. Bartsch, **A. Y. Schumann**, T. Penzel, S. Havlin, and J. W. Kantelhardt, *Detection of cardiorespiratory synchronization based on reconstructed respiration*, Chaos 19(1):015106 (2009), **contrib. 50%, 8 pages**
4. **A. Y. Schumann**, A. Bauer, T. Penzel, G. Schmidt, and J. W. Kantelhardt, *Cardiovascular oscillations and correlations during sleep*, Proc. 5th Conference of the European Study Group on Cardiovascular Oscillations, Parma, Italy (2008), **contrib. 85%, 4 pages**
3. **A. Y. Schumann**, J. W. Kantelhardt, A. Bauer, and G. Schmidt, *Bivariate phase-rectified signal averaging*, Physica A 387, 5091 (2008), **contrib. 80%, 10 pages**
2. J. W. Kantelhardt, A. Bauer, **A. Y. Schumann**, P. Barthel, R. Schneider, M. Malik, and G. Schmidt, *Phase-rectified signal averaging for the detection of quasi-periodicities and the prediction of cardiovascular risk*, Chaos 17, 015112 (2007), **contrib. 50%, 9 pages**
1. A. Witt[†], **A. Y. Schumann**, *Holocene climate variability on millennial scales recorded in Greenland ice cores*, Nonlinear Processes in Geophysics 12: 1-8, (2005), SRef-ID: 1607-7946/npg/2005-12-1, **contrib. 50%, 8 pages**

Invited Talks and Lectures

9. **A. Y. Schumann**, "Synfire Chain Like" Behaviour in Voltage-Sensitive Dye Imaging, Department of Neuroscience, Canadian Centre for Behavioural Neuroscience (Majid Mohajerani's Optical Imaging Group), University of Lethbridge, Canada (2014)
8. **A. Y. Schumann**, *Inferring Dependence in Functional Networks from Studying Time Series – A Very Limited Methodological Overview*, Department of Neuroscience, The Polaris Group on Brain Dynamics (Aaron Gruber's, Mathew Tata's, Bruce McNaughton's Group), University of Lethbridge, Canada (2013)
7. **A. Y. Schumann**, *Cross modulation analysis to study physiological coupling in healthy and pathologic EEG data*, SAGE/Biostatistics Seminar, Department of Mathematics and Statistics, University of Calgary, Canada (2013)
6. **A. Y. Schumann**, *Inferring Dependence in Functional Networks from Studying Time Series – Coherence and Synchronization based Methods*, Department of Physics and Astronomy (Davidsen Group), University of Calgary, Canada (2012)
5. **A. Y. Schumann**, *Identification of Dynamical Transitions by Recurrence Network Analysis of Time Series*, Department of Physics and Astronomy (Davidsen Group), University of Calgary, Canada (2012)
4. **A. Y. Schumann**, *Fluctuations and Synchronization in Complex Physiological Networks*, Department of Clinical Neurosciences (Zelma Kiss' Group), University of Calgary (2011)
3. **A. Y. Schumann**, *Extreme Events In Correlated Levy Processes*, Complexity Science Group (Maya Paczuski's Group), Department for Physics and Astronomy, University of Calgary, Canada (2010)
2. **A. Y. Schumann**, *Cross-modulated amplitudes and frequencies in the human EEG*, Complexity Science Group (Maya Paczuski's Group), Department for Physics and Astronomy, University of Calgary, Canada (2010)
1. **A. Y. Schumann**, *Bivariate Phase Rectified Signal Averaging (BPRSA) - A Tool for studying complex interrelated time series and selected topics studied at BIU and MLU within project DAPhNet*, Seminar on Complex Data Analysis (Sorin Solomon's Group), Hebrew University Jerusalem, Israel (2008)

Conference Contributions (Abstracts, Talks, and Posters)

27. **A. Y. Schumann**, N. R. Moloney, J. Davidsen *Extreme value and record statistics in heavy-tailed processes with long-range memory*, Congress of the Canadian Association of Physicists, Calgary, Canada (2012, talk)

26. **A. Y. Schumann**, K. Stumpf, M. Plotnik, F. Gans, T. Penzel, I. Fietze, J. M. Hausdorff, J. W. Kantelhardt, *Effects of Parkinson's disease on EEG coupling during sleep*, Congress of the Canadian Association of Physicists, Calgary, Canada (2012, poster)
25. C. P. Christensen, **A. Y. Schumann**, C. Turner, *Sleep research reloaded - A cost efficient, portable monitoring device for ambulatory polysomnographies*, Congress of the Canadian Association of Physicists, Calgary, Canada (2012, poster)
24. **A. Y. Schumann**, N. R. Moloney, J. Davidsen *Extreme value and record statistics in heavy-tailed processes with long-range memory*, Fall Meeting of the American Geophysical Union, San Francisco, U.S.A. (2011, poster)
23. **A. Y. Schumann**, N. R. Moloney, J. Davidsen *Extreme value and record statistics in heavy-tailed processes with long-range memory*, 16th Itzykson Meeting "Extremes and Records", Saclay, France (2011, poster)
22. **A. Y. Schumann**, R. P. Bartsch, A. Kuhnhold*, T. Penzel, P. Ch. Ivanov, J. W. Kantelhardt, *Aging effects on cardio-respiratory coupling across sleep stages*, 6th Conference of the European Study Group of Cardiovascular Oscillations, Berlin, Germany (2010, talk)
21. **A. Y. Schumann**, K. Stumpf, M. Plotnik, F. Gans, T. Penzel, I. Fietze, J. M. Hausdorff, J. W. Kantelhardt, *Effects of Parkinson's disease on EEG coupling during sleep*, SLEEP 2010: 24th Annual Meeting of the Association of Professional Sleep Societies, San Antonio (TX), U.S.A., 5-9 June 2010 (poster)
20. R. P. Bartsch, **A. Y. Schumann**, J. W. Kantelhardt, S. Havlin, P. Ch. Ivanov, *Sleep stage and age dependence of cardio-respiratory coupling in healthy subjects*, SLEEP 2010: 24th Annual Meeting of the Association of Professional Sleep Societies, San Antonio (TX), U.S.A., 5-9 June 2010 (poster)
19. T. Penzel, **A. Y. Schumann**, R. P. Bartsch, P. Ch. Ivanov, J. W. Kantelhardt, *Aging effects in cardio-respiratory variability in different sleep stages*, SLEEP 2010: 24th Annual Meeting of the Association of Professional Sleep Societies, San Antonio (TX), U.S.A., 5-9 June 2010 (poster)
18. **A. Y. Schumann**, F. Gans, K. Stumpf, J. W. Kantelhardt, *Cross-modulated amplitudes and frequencies in the human EEG*, European Dynamics Days 2009, Göttingen, Germany (talk)
17. **A. Y. Schumann**, *Algorithms to study cross-modulations in multivariate brain signal data*, Workshop on Complex Brain Dynamics, Sleep and Consciousness, Dresden (2009, talk during seminar)
16. **A. Y. Schumann**, *Artifacts in large polysomnographic databases*, Workshop on Complex Brain Dynamics, Sleep and Consciousness, Dresden (2009, talk during seminar)
15. **A. Y. Schumann**, F. Gans, J. W. Kantelhardt *Cross-modulated amplitudes and frequencies in the human EEG*, Workshop on Complex Brain Dynamics, Sleep and Consciousness, Dresden (2009, poster)
14. **A. Y. Schumann**, *Fractal properties and cross-modulation analysis of EEG data from Parkinson and sleep apnea patients vs. age-matched healthy controls during sleep*, DAPHNET Workshop 2009, Rauischholzhausen, Germany (talk)
13. **A. Y. Schumann**, *Algorithms of synchronization analysis*, DAPHNET European Union Project Meeting, Berlin, Germany (2009, talk)
12. **A. Y. Schumann**, *Bivariate Phase Rectified Signal Averaging - A tool for studying complex interrelations in climate data*, 1st International Workshop on Data Analysis and Modelling in Earth Sciences, Potsdam, Germany (DAMES 2008, talk)
11. **A. Y. Schumann**, *Beyond cross-correlation analysis: Bivariate phase rectified signal averaging*, DAPHNET European Union Project Rehearsal, Madrid, Spain (2008, talk)
10. **A. Y. Schumann**, A. Bauer, T. Penzel, G. Schmidt, J. W. Kantelhardt, *Cardiovascular oscillations and correlations during sleep*, 5th Conference of the European Study Group of Cardiovascular Oscillations, Parma, Italy (2008, talk)
9. **A. Y. Schumann**, *Bivariate Phase Rectified Signal Averaging*, DAPHNET European Union Project Meeting, Bruxelles, Belgium (2008, talk)
8. **A. Y. Schumann**, J. W. Kantelhardt, *Multivariate phase rectified signal averaging and the investigation of baroreflex sensitivity*, 293rd Wilhelm and Helene Heraeus Seminar, Ilmenau, Germany (2008, poster)
7. **A. Y. Schumann**, J. W. Kantelhardt, F. Gans *Multivariate phase rectified signal averaging - A tool for studying complex interrelated time series*, Congress of German Physical Society, Berlin, Germany (2008, talk)
6. **A. Y. Schumann**, J. W. Kantelhardt, *Multivariate phase rectified signal averaging for study of complex inter-related time series*, Nonlinear Dynamics and Chaos: Advances and Perspectives, Aberdeen, UK (2007, poster)

5. **A. Y. Schumann**, J. W. Kantelhardt, *Multivariate phase rectified signal averaging - For study of complex inter-related time series*, Natural Complexity: Data and Theory in Dialogue, Cambridge, UK (2007, poster)
4. **A. Y. Schumann**, J. W. Kantelhardt, A. Bauer, G. Schmidt, *Multivariate phase rectified signal averaging*, STATPHYS 23, International Conference for statistical physics, Genova, Italy (2007, poster)
3. **A. Y. Schumann**, J. W. Kantelhardt, T. Penzel, *Age-dependence of correlations and quasi-periodicities in heart rate and respiration during sleep*, Congresses of German Physical Society, Dresden, Germany (2006, poster)
2. **A. Y. Schumann**, J. W. Kantelhardt, T. Penzel, A. Bauer, G. Schmidt, *Age and sleep stage dependence of deceleration capacity as an indicator for cardiac risk*, International Congress on Sleep and the Cardiovascular System, Marburg, Germany (2006, poster)
1. **A. Y. Schumann**, J. W. Kantelhardt, *Detrended fluctuation analysis of heartbeat data during healthy sleep*, 346. WE-Heraeus-Seminar: Cardiovascular Physics - Model Based Data Analysis of Heart Rhythm, Bad Honnef, Germany (2005, poster)

Teaching Experience

Professional Certification

- Nov 2012 Faculty Teaching Certificate (FTC) - Teaching and Learning Center, Univ. of Calgary
 Jun 2012 Instructional Skills Workshop (ISW) - Teaching and Learning Center, Univ. of Calgary

Instruction

- 2018 **Instructor** Physics - PHYS204 *College Physics II - Thermodynamics, Electrodynamics, Optics, Relativity, Quantummechanics*, Department of Physics, The Citadel – Military College of South Carolina, Charleston, U.S.A.; 3 credit hours lecture; 30 students.
- 2018 **Instructor** Physics - PHYS271 *Calculus-Based Physics I (Engineers&Physicists) - Mechanics*, Department of Physics, The Citadel – Military College of South Carolina, Charleston, U.S.A.; 2 credit hours lecture/lab; 17 students.
- 2018 **Instructor** Physics - PHYS254 *LAB College Physics II - Thermodynamics, Electrodynamics, Optics, Relativity, Quantummechanics*, Department of Physics, The Citadel – Military College of South Carolina, Charleston, U.S.A.; 2 credit hours lecture/lab; 17 students.
- 2017 **Instructor** Physics - PHYS203 *College Physics I - Mechanics and Thermodynamics*, Department of Physics, The Citadel – Military College of South Carolina, Charleston, U.S.A.; 3 credit hours lecture; 34 students.
- 2017 **Instructor** Physics - PHYS253 *LAB College Physics I - Mechanics*, Department of Physics, The Citadel – Military College of South Carolina, Charleston, U.S.A.; 2 credit hours lab; 20 students.
- 2017 **Instructor** Physics - PHYS272 *Calculus-Based Physics II (Engineers&Physicists) - LAB Thermodynamics, Electricity, and Optics*, Department of Physics, The Citadel – Military College of South Carolina, Charleston, U.S.A.; 2 credit hours lab; 18 students.
- 2017 **Instructor** Physics - PHYS204 *College Physics II - Thermodynamics, Electrodynamics, Optics, Relativity, Quantummechanics*, Department of Physics, The Citadel – Military College of South Carolina, Charleston, U.S.A.; 3 credit hours lecture; 32 students.
- 2017 **Instructor** Physics - PHYS254 *LAB College Physics II - Thermodynamics, Electrodynamics, Optics, Relativity, Quantummechanics*, Department of Physics, The Citadel – Military College of South Carolina, Charleston, U.S.A.; 2 credit hours lecture/lab; 17 students.
- 2017 **Instructor** Physics - PHYS271 *Calculus-Based Physics I (Engineers&Physicists) - Mechanics*, Department of Physics, The Citadel – Military College of South Carolina, Charleston, U.S.A.; 2 credit hours lecture/lab; 2 Sections, 16 and 18 students.
- 2016 **Instructor** Physics - PHYS203 *College Physics I - Mechanics, Solids, Fluids, Waves*, Department of Physics, The Citadel – Military College of South Carolina, Charleston, U.S.A.; 3 credit hours lecture; 30 students.
- 2016 **Instructor** Physics - PHYS253 *LAB College Physics I - Mechanics*, Department of Physics, The Citadel – Military College of South Carolina, Charleston, U.S.A.; 2 credit hours lecture/lab; 3 Sections, 16 students each.

- 2016 **Instructor** Physics - PHYS271 *Calculus-Based Physics I (Engineers&Physicists) - Mechanics*, Department of Physics, The Citadel – Military College of South Carolina, Charleston, U.S.A.; 2 credit hours course; 16 students.
- 2015 **Guest Lecturer** *Deep Learning, Neural Networks* in Machine Learning Group, Department for Computer Science, College of Charleston, U.S.A.; course of Brent Munsell
- 2014 **Lecturer** *Computational Neuroscience - An Introduction to Image Processing and Time Series Analysis in Neuroscience using Matlab* – Campus Alberta Neuroscience Initiative – University of Lethbridge, University of Calgary, University of Alberta (Edmonton), Canada
- 2012 **Guest Lecturer** Physics - PHYS221 *Classical Mechanics*, University of Calgary; undergraduate physics course of Jörn Davidsen, ca. 120 students
- 2012 **Substitute Lecturer** Physics - PHYS223 *Introductory Electromagnetism, and Thermal Physics*, University of Calgary; undergraduate physics course of Daria Ahrensheimer, ca. 150 students, 3 × 50min (1 week)
- 2011 **Substitute Lecturer** Physics - PHYS609 *Advanced Classical Mechanics*, University of Calgary; graduate physics course of Jörn Davidsen, ca. 15 students, 1 × 90min
- 2011 **Substitute Lecturer** Physics - PHYS611 *Statistical Physics*, University of Calgary; graduate physics course of Jörn Davidsen, ca. 10 students, 1 × 90min
- 2008-2009 **Substitute Lecturer** Theoretical Physics - *Classical Mechanics I&II*, Martin Luther University Halle-Wittenberg; undergraduate physics course of Jan Werner Kantelhardt, ca. 40 students, ca. 10 × 90min
- 2007 **Lecturer** Programming with C++ for Physicists, Martin Luther University Halle-Wittenberg; course development and instruction, 90min weekly, one academic year, ca. 10 students
- 2006 **Team Teaching and Assistant Lecturer** Computational Physics, Martin Luther University Halle-Wittenberg; course development and instruction together with Jan Werner Kantelhardt, 90min weekly, one academic year

Undergraduate Laboratories and Mentoring

- 2003-2007 **Teaching Assistant** laboratories “*Physikalisches Grundpraktikum*” for physicists and medical students, Martin Luther University Halle-Wittenberg (2005-2007) and University of Potsdam (2003), 6h weekly during academic year, various undergraduate experimental physics topics including mechanics, electrostatics, classical electrodynamics, optics, thermal physics, nuclear physics
- 2002 **Tutor for Undergrads** in *Physics*, University of Potsdam; exercise supervision problem sets in Experimental Physics, 90min weekly during academic year

High School Teaching Activity at K-12 Level

- 2018-2019 **Senior Research Projects Supervisor** Ms. Sidney Simpson '19 (Math and Science School), Ms. Allyssa Noone '19 (Ashley Hall School).
- 2017 **Summer School on the Physics of Complex Systems / Econophysics**, 2 weeks
- 2015-2017 **Senior Research Projects Supervisor** in collaboration with Ashley Hall School, Charleston, S.C., U.S.A. (Ms. Audrey Hamilton '16, Ms. McCrae Nistad '16, Ms. Madeleine Schutte '17, Ms. Lixue Chen '17, Ms. Chasity Simmons '18)
- 2015-2016 **Mathematics and Science Tutor** in collaboration with Ashley Hall School, Charleston, S.C., U.S.A.
- 2000-2005 **Lead Continuing Education Teacher of *Mathematics and Physics*** for high-school seniors and adults at Schülerhilfe in Potsdam (excl. 02/2004-09/2004 due to research stay at UC San Diego), 10 courses weekly, 90min each, full school year, mostly evenings, ca. 10 students per course.

Theses Supervision

MD

- 2017 Research portion MD-Residency Qualification of Mrs. Lauren Das, MUSC - *Maternal Anxiety as a Risk Factor for Preterm Birth* (defended 04/2017)

M.Sc.

- 2014 Master thesis of Mr. Javad Moradpour Taleshi, U Calgary - „*Nontrivial Decay of Aftershock Density With Distance in Southern California*“ (co-supervision in ETAS model simulations, main adviser: J.Davidsen; defended 07/2014)

- 2011 Diploma thesis of Ms. Anja Kuhnhold, MLU Halle-Wittenberg - *“Methods for studying phase synchronization in physiological long-term recordings”* (defended 01/2011)
- 2010 Diploma thesis of Ms. Katharina Fuchs, MLU Halle-Wittenberg - *“Multivariate time series analysis of electrophysiological signals during sleep”* (defended 09/2010)
- 2008 Diploma thesis of Mr. Fabian Gans, MLU Halle-Wittenberg - *“Correlation- and synchronization analysis of polysomnographic data employing methods from statistical physics”* (defended 10/2008)

B.Sc.

- 2012 Bachelor’s thesis of Mr. Patrick Wohlfahrt, MLU Halle-Wittenberg - *“Spectral analysis of accelerometer data to identify human movement patterns”* (defended 09/2012); external reviewer & member examination committee with grading authority
- 2011 Bachelor’s thesis of Ms. Kathrin Hohmann, MLU Halle-Wittenberg - *“Methods of synchronization analysis in application to EEG data in Parkinson patients”* (defended 07/2011); external reviewer & member examination committee without grading authority
- 2011 Bachelor’s thesis of Ms. Tina Fuhrmann, MLU Halle-Wittenberg - *“Studying baroreflex sensitivity in sleep recording and challenging Eckberg’s respiratory gate theory”* (defended 08/2011)
- 2009 Bachelor’s thesis of Mr. Kilian Stumpf, MLU Halle-Wittenberg - *“Crossmodulations in multivariate physiological data”* (defended 7/2009); internal reviewer & member examination committee with grading authority

Supervised Undergraduate Research Interns

With final reports, oral presentations, grades; internships were 3-6 months; date in parentheses indicates month of final examination

- 2012 Ms. Esther Danielle Weil - *“Dynamical Functional Brain Networks Using Data from a Portable Recording Device”* (10/2012, Calgary)
- 2012 Mr. Patrick Kesper - *“Partial Mutual Information in Complex Networks”* (10/2012, Calgary)
- 2012 Mr. Niklas Gerdes - *“Portable Recording Devices in Deep Brain Stimulation Research”* (08/2012, Calgary)
- 2011 Ms. Antje-Sophie Brückner - *“A Portable Recording Device for Physiological Signals”* (10/2011, Calgary)
- 2011 Mr. Patrick Wohlfahrt - *“Functional Networks During Sleep”* (10/2011, Calgary)
- 2011 Mr. Julian Kranz - *“Extreme value statistics in physiological signals”* (10/2011, Calgary)
- 2009 Ms. Anja Kuhnhold - *“Reconstruction of respiration signals from heartbeat-interval data and heartbeat-amplitude data”* (08/2009, Halle)
- 2008 Ms. Katharina Fuchs - *“Comparing analysis of short-term and long-term correlations in heartbeat and blood pressure in 120 healthy subjects”* (12/2008, Halle)
- 2008 Mr. Martin Schöne - *“Analysis of phase synchronization between heartbeat and gait in Parkinson’s disease and healthy controls”* (10/2008, Halle)
- 2008 Ms. Janett Liebich - *“Analysis of spontaneous phase synchronization between heartbeat and gait under normal activity”* (08/2008, Halle)
- 2008 Mr. Ulrich Skrzypczak - *“Analysis of baroreflex in post-infarction patients”* (04/2008, Halle)
- 2008 Mr. Andreas Pohl - *“Differentiation of short-term and long-term correlated time series by centered moving average analysis (CMA)”* (02/2008, Halle)
- 2008 Mr. Benno Werlich - *“Multifractal extension of centered moving average analysis (CMA) to study complex time series”* (01/2008, Halle)
- 2007 Mr. Fabian Gans - *“Analysis of cross-correlations between heartbeat and blood-pressure using multivariate phase-rectified signal averaging (MPRSA)”* (08/2007, Halle)
- 2007 Ms. Josephine Metzkes - *“Analysis of blood-pressure fluctuations using multifractal centered moving average analysis (MF-CMA)”* (07/2007, Halle)
- 2006 Ms. Kerstin Schäler - *“Time series analysis of ECG data using phase-rectified signal analysis (PRSA)”* (07/2006, Halle)
- 2006 Ms. Anke Höfer - *“Detrended fluctuation analysis of recorded and artificially generated long-term ECG recordings”* (07/2006, Halle)
- 2005 Mr. Kay Schlosser - *“Analysis of long-term correlations in heartbeat”* (09/2005, Halle)

Successful Research Grants

- 2017-2018 *Olfactory Biomarkers of Aging: Investigating the Role of Stress, Trauma, Psychiatric, and Neurologic Brain Disorders* (PI: Bernadette Cortese, Role: Data Analysis & Statistics)
- 2017-2018 *Transcranial Magnetic Stimulation for Depressed Adults with Autism Spectrum Disorder* (PI: Frampton Gwynette, Role: Data Analysis & Statistics)
- 2017 *Odor Conditioned Sedation* (PI: Thomas Uhde, Role: Data Analysis & Statistics)
- 2016-2018 Sponsor: Tal Medical (Pro00055979); *Double-Blind, Sham-Controlled Crossover Pilot Study of Low Field Magnetic Stimulation (LFMS) on Subjective and Objective Measures of Sleep* (PI: Thomas Uhde, Role: Data Analysis & Statistics)
- 2016-2018 Sponsor: Tal Medical (Pro00059499); *A Pilot Trial Investigating the Effect of Applying Low Field Magnetic Stimulation (LFMS) in Slow Wave Sleep on Electrographic (EEG) Power in Healthy Adults* (PI: Thomas Uhde, Role: Data Analysis & Statistics)
- 2014/2015 Canadian Foundation for Innovation (CFI) Team Grant (PI: Majid Mohajerani; Team Leader: Robert Sutherland) „*Dynamic Brain Mapping: Cell signalling to systems function*“, University of Lethbridge; value \$2,098,277 CAD
- 2012-2014 Co-PI Alberta Innovates R&D Associate grant for Dr. Claire Christensen, Avatar EEG Solutions Inc.; value \$124,000 CAD
- 2013 Travel Grant to Germany – German-Canadian Centre for Innovation and Research (GCCIR); value \$2,000 CAD
- 2012 Co-PI NSERC ENGAGE grant for Dr. Claire Christensen - „*Novel Applications of Time-Series Analysis and Information Theory to the Validation and Improvement of Signal Quality in an Innovative, Portable Brain-Wave Recording Device*“, University of Calgary; value \$25,000 CAD
- 2012 PI: DAAD Rise Weltweit grant for Mr. Patrick Kesper from Technical University Göttingen (3 month fully funded internship at University of Calgary); value \$5,000 CAD
- 2012 PI: DAAD Rise Weltweit grant for Mr. Niklas Gerdes from Jacobs University Bremen (3 month fully funded internship at University of Calgary); value \$5,000 CAD
- 2012 PI: DAAD PROMOS grant for Ms. Esther Danielle Weil from Justus Liebig University Gießen (fully funded internship at University of Calgary); value \$5,000 CAD
- 2011 PI: DAAD Rise Weltweit grant for Mr. Julian Kranz from Technical University Karlsruhe (3 months fully funded internship at University of Calgary); value \$5,000 CAD
- 2011 PI: DAAD Rise Weltweit grant for Ms. Antje Brückner from MLU Halle-Wittenberg (3 months fully funded internship at University of Calgary); value \$5,000 CAD
- 2011 PI: DAAD PROMOS grant for Mr. Patrick Wohlfahrt from MLU Halle-Wittenberg (3 months fully funded internship at University of Calgary); value \$5,000 CAD
- 2006-2009 Participation in proposal/deliverables European Union Project DAPHNET („*Dynamical Analysis of Physiological Networks*“), FP6 IST 018474-2 (PI: Armin Bunde and Jan Kantelhardt); total value 2,100,100 EUR
- 2005-2009 Participation in report writing Deutsche Forschungsgesellschaft project KA 1676/3 „*Diagnostic Time Series Analysis of Heartbeat and Respiration in Parkinson patients, sleep disorders, and cardiac arrhythmia in comparison with healthy controls*“ (PI Jan Kantelhardt); value 115,000 EUR

Grant Proposals under Preparation/Review

- 2017 NIH R21 *Effects of Acute and Chronic Stress on the Structure and Function of the Olfactory System* (PI: Bernadette Cortese, Co-PI: AYS; Data Analysis and Statistics)
- 2017 NIH R21 *Accelerated Neurodegeneration and Cognitive Decline: Effects of Cumulative Emotional Trauma Exposure* (PI: Bernadette Cortese, Co-PI: AYS; Data Analysis and Statistics)

Unsuccessful Proposal

- 2013 Only applicant supported by University of Lethbridge for 2013/2014 Banting Fellowship competition - Canada's most prestigious postdoctoral fellowship; requested funds \$140,000 CAD (not-funded; declared too ambitious and not feasible for given time frame of 2 years)

Conference Organization (Member Organizing Team)

- 2012 *Canadian Association of Physicists Congress*, Calgary, Canada; Conference IT and Audio-Visual Systems
- 2008 *293rd Wilhelm and Helene Heraeus Seminar*, Ilmenau, Germany; Conference Program, Abstracts, Booklet, Proceedings Book

Administration

- 2013 Represented Canadian Province of Alberta and Avatar EEG Solutions Inc. on Economic SME Development and Trade Mission to Germany
- 2010-2013 Postdoc Representative on Faculty of Science Council, University of Calgary, Canada
- 2012 Member Examination Committee B.Sc. thesis of Mr. Patrick Wohlfahrt, Department of Physics, Martin-Luther University Halle-Wittenberg, External Reviewer with grading authority
- 2011 Member Examination Committee B.Sc. thesis of Ms. Kathrin Hohmann, Department of Physics, Martin-Luther University Halle-Wittenberg, External Reviewer without grading authority
- 2009 Member Examination Committee B.Sc. thesis of Mr. Kilian Stumpf, Department of Physics, Martin-Luther University Halle-Wittenberg, Internal Reviewer with grading authority

Editorial and Reviewing Activity

- Review Editor: *Frontiers in Fractal Physiology*
- Adhoc Reviewer: *Physica A*, *Physiological Measurements*, *Europhysics Letters*, *Physical Review E*, *Physical Review Letters*, *Journal of Physics Special Topics*, *Journal of Geophysical Research*, *Geophysical Research Letters*, *Nonlinear Processes in Geophysics*, *Chaos*, *Journal of Neural Engineering* . . .

Professional Memberships

- 2012-pres. Canadian Association of Physicists (CAP)
- 2011-pres. American Geophysical Union (AGU)
- 2010-pres. Canadian Prairie Theoretical Physics Network (CPTPN)
- 2006-pres. Deutsche Physikalische Gesellschaft (DPG)

IT & System Administration

- 2015 **System Administrator / Go-To Guy**, Linux computing infrastructure of Brain Vision Lab, Department of Neurosciences, Medical University of South Carolina, U.S.A.
- 2013-2014 **System Administrator**, Linux/Windows computing systems, Systems Neuroscience Group, Canadian Centre for Behavioural Neuroscience, University of Lethbridge, Canada; **User:** IBM Platform LSF HPC cluster with 768 CPUs
- 2010-2013 **System Administrator & Webmaster** Linux, Complexity Science Group, Department of Physics, University of Calgary, Canada
- 2005-2010 **System Administrator**, Linux, Computational Nanoscience Group, Department of Physics, University of Halle, Germany; **User:** Sun's Grid Engine HPC cluster with 320 CPUs
- 1997-2000 **IT Consultant** (part time), Windows Clients & UNIX Servers, IBM Germany

Language Skills

- Native: German
- Fluent: English (IELTS score 8 - very good user)
- Basic: Russian (fluent after 8 years in school, unpracticed since 1996)

Computer Skills (selected)

Languages: C/C++ (advanced, 10+ years), LaTeX (expert); Fortran, Python, Java, Android, XML; Embedded Programming (EFM32 ARM Cortex M3, CodeSourcery)
OS: GNU/Linux (expert, 10+ years); literacy in Microsoft Windows and Office
Visualization: Matlab (expert), IDL/xmgrace (expert); ghostscript, Octave, Mathematica, R
Tools: *Editing* – vim; *Building* – make, Eclipse (Android); *Scripting* – bash, sed/awk, Perl
Web: Drupal, HTML

Personal Interests

1. Finance, Management, Administration, Event Organization
2. Teaching, Student Supervision
3. Outdoors, Traveling
4. Meeting people from all over the world, Different Cultures, International Politics, Law
5. Member of German Alpine Club Section Halle/Saale (“Deutscher Alpenverein”, DAV), Hostelling International Chapter Germany (“Deutscher Jugendherbergverein”, DJH)