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Education

UCSF Sloan-Swartz Center for Theoretical Neurobiology, Postdoctoral fellow 1/98-present
Stanford Applied Physics, Doctor of Philosophy 4/93-1/98
Stanford Applied Physics, Master of Science (GPA 3.9/4.0) 9/91-4/93
Stanford Physics, Bachelor of Science (with Honors, GPA 3.9/4.0) 9/87-6/91

Grants, Fellowships and Awards

Individual National Research Service Award, NIDCD/NIH (priority score of 118) 9/01-present
University of California President's Postdoctoral Fellowship 9/99-8/01
Bank of America Giannini Foundation Fellowship for Medical Research in California 3/99, declined
UCSF Research Evaluation and Allocation Committee Grant (Ken Miller as PI) 12/98
Sloan Foundation Postdoctoral Fellowship 1/98-present
Joint Services Electronics Program Graduate Fellowship 10/95-12/97
National Defense Science and Engineering Graduate Fellowship 10/91-9/94
Carrington Award for Outstanding Achievement and Service in Physics 6/91
Levine Award for Outstanding Undergraduate Scholarship in Physics 10/90
Undergraduate Research Opportunities Program Major Grant Recipient 3/90
Stanford President's Award for Academic Excellence 10/88

Research Experience

UCSF Sloan-Swartz Center for Theoretical Neurobiology, Postdoctoral fellow 1/00-present
COMPUTATIONAL NEUROETHOLOGY OF THE MOUSE ULTRASOUND COMMUNICATION SYSTEM
Prof. Michael Merzenich, Prof. Kenneth Miller, Prof. Christoph Schreiner (Co-advisors)
▪ Developed a mouse auditory cortex preparation to analyze neural codes within a behavioral context in a genetically accessible animal model
▪ Analyzed acoustic structure of calls, identifying possible perceptual categories
▪ Found temporal structure in neural activity matching natural call properties
▪ Identified potential representation in auditory cortex of a categorical border

UCSF Sloan-Swartz Center for Theoretical Neurobiology, Postdoctoral fellow 1/98-12/01
VARIABILITY AND INFORMATION IN A NEURAL CODE OF THE CAT LATERAL GENICULATE NUCLEUS (LGN)
Prof. Kenneth Miller (Advisor)
▪ Analyzed response variability of LGN neurons to flashing visual stimuli
▪ Found temporal precision of action potentials (spikes) on the order of 1-2 ms, and spike count precision much less than expected for a Poisson process
▪ Measured information rates as high as 3.6 bits per spike, with little signs of substantial redundancy in successive spikes

Curriculum vitae

- NTT Basic Research Labs** *Atsugi, Japan*, Student trainee 1/96-4/96
Dr. Seigo Tarucha (Advisor)
▪ Fabricated nanostructure devices
- Stanford** *E. L. Ginzton Laboratory*, Doctoral student 9/92-12/97
QUANTUM NOISE IN MESOSCOPIC ELECTRON TRANSPORT
Dr. Yoshihisa Yamamoto (Thesis advisor)
▪ Applied concepts from quantum optics to mesoscopic physics, starting a new research direction in quantum electron optics
▪ Theoretical and computational approaches: analyzed electron current noise
▪ Experimental approaches: fabricated mesoscopic semiconductor devices; developed sensitive noise measurement schemes; set up experimental lab; measured first quantum statistical interference between colliding electrons
- Stanford** *E. L. Ginzton Laboratory*, Research rotation student 4/92-8/92
Prof. Robert Byer (Advisor)
▪ Studied feasibility and analyzed noise of cryogenic optical resonators
- Stanford** *E. L. Ginzton Laboratory*, Research rotation student 1/92-3/92
Prof. Martin Fejer (Advisor)
▪ Characterized materials for nonlinear optics
- Stanford** *E. L. Ginzton Laboratory*, Research rotation student 9/91-12/91
Prof. Malcolm Beasley (Advisor)
▪ Built probe to measure phase transitions in molecular beam synthesis chamber
- Stanford** *Department of Physics*, Honors student 6/90-6/91
Prof. Douglas Osheroff (Advisor)
▪ Built cryogenic torsional oscillator to measure the gravitational constant
- Army Corps of Engineers** *Construction Engineering Research Lab*, Programmer 10/86-9/88
Dr. Paul Schomer (Advisor)
▪ Developed acoustic noise monitoring system for aircraft at Army airbases

Teaching Experience

- Stanford** *Applied Physics*, Teaching assistant for graduate Quantum Optics 1/93-6/93
- Stanford** *Physics*, Teaching assistant for undergraduate Electromagnetics 4/90-6/90

Academic Service

- UCSF** *Sloan-Swartz Center for Theoretical Neurobiology* 9/00-12/00
▪ Organized faculty lecture series for new Sloan postdoctoral fellows
- Flood Magnet School** *Menlo Park, CA*, Volunteer teacher 10/96-6/97
▪ Taught science to 3rd graders
- Optical Society of America** *Stanford student chapter*, Vice-president 9/96-6/97
- Flood Magnet School** *Menlo Park, CA*, Volunteer teacher 10/94-12/95
▪ Taught after-school science activities to 1st through 4th graders
- Ronald McNair Middle School** *East Palo Alto, CA*, Volunteer teacher 9/93-5/94
▪ Taught science and math to 7th and 8th graders
- Stanford** *Explorama Museum*, Volunteer 1/91-6/91
▪ Designed and fabricated a laser delay line cavity demonstration

Professional Associations

American Association for the Advancement of Science	2000-present
American Physical Society	1994-present
Association for Research in Otolaryngology	2002-present
International Society for Neuroethology	2001-present
Optical Society of America	1994-1998
Society for Neuroscience	1999-present

Publications (Neuroscience)

R. C. Liu, J. F. Linden and C. E. Schreiner, *Pup vocalization statistics reflected in temporal response properties of mouse auditory cortex*, in preparation for submission to **Nature Neuroscience**.

R. C. Liu, K. D. Miller, M. M. Merzenich and C. E. Schreiner, *Acoustic variability and distinguishability among mouse ultrasound vocalizations*, **Journal of the Acoustical Society of America** 114 (in press, December 2003).

J. F. Linden, R. C. Liu, M. Sahani, C. E. Schreiner and M. M. Merzenich, *Spectrotemporal structure of receptive fields in areas AI and AAF of mouse auditory cortex*, **Journal of Neurophysiology** 90: 2660-2675 (October 2003).

R. C. Liu, S. Tzonev, S. Rebrik and K. D. Miller, *Variability and information in a neural code of the cat lateral geniculate nucleus*, **Journal of Neurophysiology** 86: 2789-2806 (December 2001).

Publications (Physics)

R. C. Liu, W. D. Oliver, J. Kim and Y. Yamamoto, *Quantum electron optics*, in "Quantum Physics at Mesoscopic Scale," ed. by C. Glattli, M. Sanquer and J. Tran Thanh Van (EDP Sciences, Les Ulis, France, 2000) pp. 163-167.

W. D. Oliver, J. Kim, R. C. Liu and Y. Yamamoto, *Hanbury Brown and Twiss-type experiment with electrons*, **Science** 284: 299-301 (April 1999).

R. C. Liu, Y. Yamamoto and S. Tarucha, *Signs of quantum statistical effects in electron collision*, **Physica B** 249-251: 152-6 (June 1998).

R. C. Liu, B. Odom, Y. Yamamoto and S. Tarucha, *Quantum interference in electron collision*, **Nature** 391: 263-265 (January 1998).

R. C. Liu, P. Eastman and Y. Yamamoto, *Inhibition of elastic and inelastic scattering by the Pauli exclusion principle: Suppression mechanism for mesoscopic partition noise*, **Solid State Communications** 102: 785-789 (June 1997).

R. C. Liu, B. Odom, J. Kim, Y. Yamamoto and S. Tarucha, *Partition noise in mesoscopic devices: Experiments in quantum electron optics*, in "Proceedings of the 23rd International Conference on the Physics of Semiconductors," ed. by M. Scheffler and R. Zimmermann (World Scientific Publishing Co. Pte. Ltd., New Jersey, 1996) pp. 2399-2402.

R. C. Liu, P. Eastman and Y. Yamamoto, *Simulations of partition noise suppression*, in "Quantum Transport in Semi-conductor Submicron Structures," ed. by B. Kramer (Kluwer Academic Publishers, The Netherlands, 1996) pp. 365-374.

R. C. Liu and Y. Yamamoto, *Partition noise in electron transport*, in "Quantum Dynamics of Submicron Structures," eds. by H. A. Cerdeira, B. Kramer and G. Schon (Kluwer Academic Publishers, The Netherlands, 1995) pp. 427-442.

R. C. Liu and Y. Yamamoto, *Conductance dependent suppression of current partition noise in mesoscopic electron branching circuits*, **Physica B** 210: 37-42 (April 1995).

R. C. Liu and Y. Yamamoto, *Nyquist noise in the transition from mesoscopic to macroscopic transport*, **Physical Review B** 50: 17411-17414 (December 1994).

R. C. Liu and Y. Yamamoto, *Suppression of quantum partition noise in mesoscopic electron branching circuits*, **Physical Review B** 49: 10520-10532 (April 1994).

Invited Presentations (Neuroscience)

R. C. Liu, *Communication and cortex: the computational neuroethology of mouse vocalizations*, Sloan-Swartz Meeting, San Diego, CA, July 26-29, 2003.

R. C. Liu, *Song and rhythm in the mouse: Cortical processing of natural vocalizations*, Seminar at Washington State University at Vancouver, Vancouver, WA, May 7, 2003.

R. C. Liu, *Song and rhythm in the mouse: Cortical processing of natural vocalizations*, Berkeley Ear Club, Berkeley, CA, April 7, 2003.

R. C. Liu, S. Tzonev, S. Rebrik, A. Kurgansky and K. D. Miller, *Cat LGN spike variability*, Neural Information Processing Systems 2000 Workshop, Breckenridge, CO, December 1-2, 2000.

Invited Presentations (Physics)

R. C. Liu, W. Oliver, J. Kim and Y. Yamamoto, *Quantum electron optics*, 18th Moriond Workshop on Quantum Physics at Mesoscopic Scale, Les Arcs, France, January 23-30, 1999.

R. C. Liu and Y. Yamamoto, *Quantum interference in electron collision*, International Symposium on Quantum Optics and Mesoscopic Physics, Atsugi, Japan, July 13, 1998.

R. C. Liu and Y. Yamamoto, *Noise suppression in electron transport*, NATO Advanced Research Workshop on "Quantum Dynamics of Submicron Structures," Trieste, Italy, June 14-30, 1994.

Contributed Presentations (Neuroscience)

R. C. Liu, J. F. Linden and C. E. Schreiner, *The representation of categorically perceived vocalizations in mouse auditory cortex*, abstract 503, 27th Annual Meeting of the Association for Research in Otolaryngology, Daytona Beach, FL, February 22-26, 2004.

R. C. Liu, J. F. Linden and C. E. Schreiner, *Auditory cortical representations of natural and synthetic mouse vocalizations*, contributed poster 182.17, 33rd Annual Meeting of the Society for Neuroscience, New Orleans, LA, November 8-12, 2003.

F. Strata, A. E. Delpolyi, E. F. Chang, H. Nakahara, R. C. Liu, and M. M. Merzenich, *Perinatal anoxia affects auditory processing and the auditory system organization in rats*, contributed poster 148.14, 33rd Annual Meeting of the Society for Neuroscience, New Orleans, LA, November 8-12, 2003.

R. C. Liu, J. F. Linden, K. D. Miller, M. M. Merzenich and C. E. Schreiner, *A mouse model for the cortical processing of species-specific vocalizations*, contributed poster 914, 31st Annual Meeting of the Association for Research in Otolaryngology, Daytona Beach, FL, February 22-27, 2003.

R. C. Liu, J. F. Linden, K. D. Miller, M. M. Merzenich and C. E. Schreiner, *The variability and distinguishability of mouse ultrasound vocalizations*, contributed poster 588.16, 32nd Annual Meeting of the Society for Neuroscience, Orlando, FL, November 2-7, 2002.

J. F. Linden, R. C. Liu, M. Sahani, M. M. Merzenich, C. E. Schreiner, *Spectrotemporal structure of receptive fields in areas A1 and AAF of mouse auditory cortex*, contributed poster 458.4, 32nd Annual Meeting of the Society for Neuroscience, Orlando, FL, November 2-7, 2002.

R. C. Liu, J. F. Linden, K. D. Miller, M. M. Merzenich and C. E. Schreiner, *A neuroethological approach to mouse ultrasound communication*, contributed poster 29, Gordon Research Conference on Neuroethology: Behavior, Evolution and Neurobiology, Queen's College, Oxford University, United Kingdom, August 18-23, 2002.

J. F. Linden, R. C. Liu, M. Kvale, C. E. Schreiner and M. M. Merzenich, *Reverse-correlation analysis of receptive fields in mouse and rat auditory cortex*, contributed poster 621.7, 31st Annual Meeting of the Society for Neuroscience, San Diego, CA, November 10-15, 2001.

R. C. Liu, J. F. Linden, K. D. Miller, M. M. Merzenich and C. E. Schreiner, *Neural responses to ultrasound vocalizations in the mouse auditory cortex*, contributed poster 512.8, 31st Annual Meeting of the Society for Neuroscience, San Diego, CA, November 10-15, 2001.

R. C. Liu, S. Tzonev, S. Rebrik, A. Kurgansky and K. D. Miller, *Spike precision and information in cat visual thalamus*, contributed poster 447.9, 30th Annual Meeting of the Society for Neuroscience, New Orleans, LA, November 4-9, 2000.

R. C. Liu, S. Tzonev, S. Rebrik, A. Kurgansky and K. D. Miller, *Minimal redundancy in the coding of visual information in the thalamus*, contributed talk JC32.6, 1999 March Meeting of the American Physical Society, Atlanta, GA, March 20-26, 1999.

Contributed Presentations (Physics)

R. C. Liu, B. Odom, J. Kim, Y. Yamamoto and S. Tarucha, *Partition noise in mesoscopic devices: Experiments in quantum electron optics*, contributed talk Th2D-2 at the 23rd International Conference on the Physics of Semiconductors, Berlin, Germany, July 21-26, 1996.

R. C. Liu, B. Odom, J. Kim, Y. Yamamoto and S. Tarucha, *Mesoscopic partition noise: Experiments in quantum electron optics*, contributed talk at the NATO Advanced Studies Institute on Mesoscopic Electron Transport, Curacao, June 25-July 5, 1996.

R. C. Liu, P. Eastman and Y. Yamamoto, *Simulations of partition noise suppression*, contributed poster II-2 at the NATO Advanced Studies Institute on Quantum Transport in Semiconductor Submicron Structures, Bad Lauterberg, Germany, August 21-31, 1995.

R. C. Liu, P. Eastman, B. Odom and Y. Yamamoto, *Shot noise suppression in mesoscopic circuits*, contributed talk II7.11, 1995 March Meeting of the American Physical Society, San Jose, CA, March 20-24, 1995.

R. C. Liu and Y. Yamamoto, *Dissipation induced squeezing in mesoscopic branching circuits*, contributed talk QThD5, 1994 International Quantum Electronics Conference, Anaheim, CA, May 8-13, 1994.

R. C. Liu and Y. Yamamoto, *Spin squeezing of quantum partition noise in mesoscopic electron branching circuits*, contributed talk O12 12, 1994 March Meeting of the American Physical Society, Pittsburgh, PA, March 21-25, 1994.