102 Waverley Avenue
Watertown, MA 02472
November 22, 2004

Biocomplexity Faculty Search Committee
c/o Prof. Rob de Ruyter van Steveninck
Biocomplexity Institute
Indiana University
Swain Hall West 117
Bloomington IN, 47405-7105

Dear Professor de Ruyter van Steveninck,

Please accept my application for the position of Assistant Professor in Biocomplexity that you advertised in naturejobs. My field of expertise is the use of theoretical and computational approaches to model the neurobiological processes necessary for memory.

My background is interdisciplinary, including physics and biology. I have collaborated successfully with professors in chemistry, biology, and physics at Brandeis and look forward to forming new collaborations with faculty in the Biocomplexity Institute, where I think I will be well-suited, as I work at both the network level and the molecular, level in neuroscience.

My ability to obtain grants is demonstrated by the funding I have already gained as a principle investigator through a Career Development Award from the National Institutes of Health. The Award has enabled me to transfer my skills from physics to become an independent investigator in neuroscience. The award runs until the end of November 2006, and can be transfered, if a new mentor (such as yourself, if you are willing) is agreed upon with NIMH.

I have significant and diverse teaching experience. I am comfortable with introductory and advanced level courses. I have taught students with backgrounds ranging from the non-scientific to the highly mathematical. Given my background as a student is in physics, I would be most suited to teaching classes in the physics department, but can certainly teach more interdiscplinary graduate level courses.

I have attached my research statement, which includes plans for future research combined with my teaching statement, and my curriculum vitae, which includes a publication list and the contact details of those who have agreed to send references.

Yours sincerely,

Dr. Paul Miller

Paul Miller: Curriculum Vitae

Personal details

102 Waverley Avenue,
Watertown, MA 02472
Tel: 617-923-4942 (h); 781-736-2890 (w)
email:pmiller@brandeis.edu
URL: http://wanglab.ccs.brandeis.edu/people/miller
UK citizen; US Permanent Resident (Green card holder)

Education

Ph.D. Oct 1991 - Oct 1994. University of Bristol, Physics Department, U.K.
Completed research toward a Ph.D. in the Theory Group, supervised by Professor B. L. Györffy. Awarded Ph.D. Dec 1994.

Undergraduate Oct 1988 - Jul 1991. Cambridge University, Peterhouse, U.K.
B.A. Honors course in Natural Sciences, specializing in Physics and Theoretical Physics. Awarded a scholarship each year, and graduated with 1st Class Honors. Awarded B.A. July 1991.

Research and Work Experience

Postdoctoral: Jul 2000 - present. Department of Physics and Volen Center for Complex Systems, Brandeis University, Waltham, MA.
Taught the sophomore physics course "Oscillations and Waves".
Attended graduate classes and seminars in neuroscience.
Managed the purchasing and installation of a 43-node Beowulf computer cluster.
Implemented networks of integrate and fire neurons to investigate models of working memory and decision-making in computational neuroscience.
Compared the effect of noise-induced hopping between discrete states versus noise-induced drift in a continuous attractor, both via simulations and mathematical analysis.
Analyzed and simulated stochastic processes to determine the stability of the CaMKII-phosphatase molecular switch for memory storage.

Postdoctoral: Jun 1997 - Jul 2000. Department of Physics, Georgetown University, Washington, DC.
Developed analytical and computational methods for solving problems with strongly-coupled superconductors and Josephson junctions.
Taught and supervised students as a teaching assistant and co-instructor in a novel course, 'The Quantum World Around Us' primarily for non-scientists.
Attended a graduate class on computational neuroscience.

Teaching: Aug 1995 - Jan 1997. Nkhotakota Secondary School, Malawi, Africa.
Headed the Science Department, and taught Mathematics, Physical Science and English at secondary level, working for Voluntary Service Overseas (U.K.).

Postdoctoral: Oct 1994 - Jul 1995. University of Bristol, Physics Department, U.K.
Postdoctoral research work on semiclassical theory of superconductors.

Doctoral Placement: Feb 1994 - Apr 1994. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Extensive use of the Intel IPSC/5 massively parallel supercomputer, for modeling of superconductors in a magnetic field.

Undergraduate Research: Sep 1987 - Sep 1988. Jul - Sep 1989, 1990, 1991. G.E.C. Hirst Research Centre, East Lane, Wembley, London.
Produced and tested high-Tc superconductor samples; developed software for automation of the testing process.

Grants

Dec 2001: NIH, Mentored Quantitative Research Career Development Award (K25) ($324,318).
As Principle Investigator, I have been awarded a five-year training grant by the National Institute for Mental Health for *Network requirements of parametric working memory.*
The grant provides my current funding. It has enabled me to gain training in neuroscience at Brandeis University and to develop into an autonomous researcher under the guidance of Prof. Xiao-Jing Wang.

Oct 1999: Pittsburgh Supercomputer Grant for self-consistent solutions in superconducting systems (1000hrs).

Awards

Dec 2001: Mentored quantitative research career development award from the National Institutes of Health (NIH-NIMH).

Oct 1988-91: Awarded a scholarship each year by Peterhouse, Cambridge, for undergraduate achievement.

Societies

Member of the Institute of Physics (U.K.), 1991-1995.
Member of the American Physical Society, 1997-2000.
Member of the Society for Neuroscience, 2001-2004.

Refereed Publications

21. Miller P, Romo R, Wang X-J: **Discrimination of temporally separated stimuli by integral feedback control.** *In preparation.* (Preprint available.)

20. Miller P, Wang X-J: **Scale-free neuronal fluctuations in a recurrent network model of parametric working memory.** *Submitted to Nature Neuroscience* (2004) (Preprint available.)

19. Miller P: Analysis of spike statistics in neuronal systems comparing a continuous attractor with multiple, discrete states. *Submitted to Physical Review E* (2004) (Preprint available.)

18.Miller P, Zhabotinsky AM, Lisman JE, Wang X-J **The stability of a stochastic CaMKII switch: dependence on the number of enzyme molecules and protein turnover.** *Submitted to Public Library of Science: Biology* (2004) (Preprint available.)

17. Miller P, Brody CD, Romo R, Wang X-J **A recurrent network model of somatosensory parametric working memory in the prefrontal cortex.** *Cereb Cortex* **13**:1208-1218 (2003).

16. Freericks JK, Nikolić B, Miller P: **Temperature dependence of Superconductor-Correlated**

Metal-Superconductor Josephson junctions. *Applied Physics Letters* **82**:970-972 (2003). *Virtual Journal of Applications of Superconductivity* Vol.4, Issue 4 (2003). Erratum: *Applied Physics Letters* **83**:1275 (2003)

15. Nikolić BK, Freericks JK, Miller P: **Suppression of the "quasiclassical" proximity gap in correlated-metal–superconductor structures.** *Physical Review Letters* **88**:77002-1–4 (2002). *Virtual Journal of Nanoscale Science & Technology* Vol. 5, Iss. 7.

14. Freericks JK, Nikolić B, Miller P: **Optimizing the Speed of a Josephson Junction with Dynamical Mean Field Theory.** *Int. J. Mod. Phys. B* **16**:531-561 (2002).

13. Nikolić B, Freericks JK, Miller P: **Equilibrium Properties of Double-Screened-Dipole-Barrier SINIS Josephson Junctions.** *Phys. Rev. B* **65**:064529-1–11 (2002); *Virtual Journal of Applications of Superconductivity* **2** Iss. 3.

12. Nikolić BK, Freericks JK, Miller P: **Reduction of Josephson critical current in short ballistic SNS weak links.** *Physical Review B* **64**:212507–1-4 (2001).

11. Freericks JK, Nikolić BK, Miller P: **Tuning a Josephson junction through a quantum critical point.** *Phys. Rev. B* **64**:54511- (2001) Erratum: *Phys. Rev. B* **68**:99901 (2003)

10. Miller P, Freericks JK: **Microscopic self-consistent theory of Josephson junctions including dynamical correlations.** *Journal of Physics: Condensed Matter* **13**:3187-3213 (2001).

9. Freericks JK, Miller P: **Dynamical Charge Susceptibility of the Spinless Falicov-Kimball Model.** *Physical Review B* **62**:10022-10032 (2000).

8. Miller P, Freericks JK, Nicol EJ: **Possible experimentally observable effects of vertex corrections in superconductors.** *Physical Review B* **58**:14498-14510 (1998).

7. Miller P, Györffy BL: **Theoretical Investigations of the Vortex Lattice and de Haas - van Alphen Oscillations in the Superconducting State.** *Journal of Physics: Condensed Matter* **7**:5579-5606 (1995).

6. Litak G, Györffy BL, Miller P: **A recursion method for solving the Bogoliubov Equations for Inhomogeneous Superconductors.** *Physica C* **251**:263-273 (1995).

5. Miller P, Györffy BL, Janko B: **On the Coexistence of Superconductivity and Charge Density Waves.** *Physica C* **210**:343-349 (1993).

4. May PW, Harrison MR, Jedamzik D, Kolinsky PV and Miller P: **Substrate-Temperature Dependence of Thin-Films of BiSrCaCuO Deposited by the Laser Ablation Method.** *Superconductor Science and Technology* **1**:333-335 (1989).

3. May PW, Harrison MR, Jedamzik D, Kolinsky PV, Miller P, Chad RJ: **Superconducting Thick-Films of BiSrCaCuO Deposited Using a Free Lasing Infrared ND-YAG Laser.** *Electronics Letters* **24**:1204-1205 (1988).

2. May PW, Boyle WJO, Harrison MR, Jedamzik D, Miller P: **Superconducting Thick-Films of BiSrCaCuO by 2 Spin-On Methods.** *Superconductor Science and Technology* **1**:71-74 (1988).

1. May PW, Boyle WJO, Jedamzik D, Miller P: **Production of Superconducting Thick-Films by a Spin-On Process.** *Superconductor Science and Technology* **1**:1-4 (1988).

Invited Talks

Parametric Working Memory with positively and negatively monotonic tuning curves.
Sloan Conference, Boston, MA June 2002.
De Haas-van Alphen oscillations in the vortex state.
Condensed Matter and Materials Physics Conference, Leeds, UK, December 1994.
Large-scale simulations of the superconducting vortex lattice.
Massively Parallel Supercomputer Conference, Taormina, Sicily, October 1994.
The Bogoliubov-de Gennes equations in a magnetic field: a chain of vortices.
Bogoliubov-de Gennes Equations Workshop, Bristol University, UK, October 1993.

Contributed Talks

Self-consistent equations of current flow in equilibrium Josephson junctions.
American Physical Society, Minneapolis, MN, March 2000.
Effects of barrier material on critical current (Ic) in Josephson junctions.
American Physical Society, Atlanta, GA, March 1999.
Vertex corrections for the 3D Holstein model.
American Physical Society, Los Angeles, CA, March 1998.

Other conference presentations

Discrimination of temporally separated stimuli by integral feedback control.
Society for Neuroscience, San Diego, CA, October 2004.
Analysis of CaMKII bistability and fluctuations due to small numbers of molecules.
Society for Neuroscience, New Orleans, LA, November 2003.
A cortical network model of parametric working memory and time integration.
Society for Neuroscience, Orlando, FL, November 2002.
Encoding parametric working memory: fine-tuning, cusps and bistabilities.
Neural Information Coding workshop (NICE) Les Houches, France, March 2002.
A Network Model of Parametric Working Memory with Monotonic Tuning Curves.
Society for Neuroscience, San Diego, CA, November 2001.

References

Professor Xiao-Jing Wang
Department of Physics and Volen Center for Complex Systems
Brandeis University
Waltham, MA 02454
xjwang@brandeis.edu
(781) 736-3147

Professor James Freericks
Department of Physics
Georgetown University
27th & O St
Washington DC 20057
jkf@physics.georgetown.edu
(202) 687-6159

Professor Laurence Abbott
Department of Biology and Volen Center for Complex Systems
Brandeis University
Waltham, MA 02454
abbott@brandeis.edu
(781) 736-2876

Professor John Lisman
Department of Biology and Volen Center for Complex Systems
Brandeis University
Waltham, MA 02454
lisman@brandeis.edu
(781) 736-3145