

# CURRICULUM VITAE

## A. BIOGRAPHICAL INFORMATION

### 1. *PERSONAL*

Name: ARUN PARAMEKANTI

Office Address: DEPARTMENT OF PHYSICS,  
UNIVERSITY OF TORONTO,  
MP 1006, MCLENNAN LABORATORY,  
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### 2. *DEGREES:*

- (a) Bachelor of Technology in Engineering Physics, Indian Institute of Technology, Bombay, India (1994).
- (b) Ph.D., Department of Theoretical Physics, Tata Institute of Fundamental Research, India (2001).  
Thesis title: "Superconductivity in strongly correlated systems"  
Supervisor: Prof. Mohit Randeria

### 3. *EMPLOYMENT*

- (a) Assistant Professor (Tenure Track), Department of Physics, University of Toronto (August 2005 - present)
- (b) Postdoctoral fellow at Lawrence Berkeley National Laboratory, Berkeley, USA (Oct. 2004 - Aug. 2005).
- (c) Postdoctoral fellow at the Department of Physics and Kavli Institute for Theoretical Physics, University of California, Santa Barbara, USA (Oct. 2001 - Sep. 2004).
- (d) Junior Research Fellow at the Condensed Matter Theory Group at the Jawaharlal Nehru Center for Advanced Scientific Research, Bangalore, India (1994-1995).

### 4. *HONOURS*

- (a) Geeta Udgaonkar Prize for Best Ph.D. Thesis, Tata Institute of Fundamental Research, India (2001).
- (b) Alfred P. Sloan Fellow (2006-2008).
- (c) Early Researcher Award (2007-2012).

### 5. *PROFESSIONAL AFFILIATIONS AND ACTIVITIES*

- (a) Referee: Physical Review Letters.
- (b) Referee: Physical Review B.
- (c) Referee: Europhysics Letters.
- (d) Referee: Nature Physics.
- (e) Referee: NSERC grant proposals.
- (f) Referee: National Science Foundation (USA) grant proposals.

## **B. ACADEMIC HISTORY**

### 1. *RESEARCH ENDEAVOURS*

**Field:** Theoretical condensed matter physics, specifically

- (a) The phenomena of superconductivity in correlated materials such as the high temperature superconductors where Coulomb repulsion leads to strong constraints on the allowed electronic configurations and consequently on the dynamics of electrons.

- (b) Quantum magnets, superfluids, and supersolids on triangular and other lattice geometries with a view to understanding how geometric frustration inherent in these lattices influences the nature of the quantum ground state and low-energy excitations in these phases.
- (c) Ultracold atomic gases in optical lattices as model systems to explore equilibrium and nonequilibrium quantum many-body effects.

## 2. RESEARCH AWARDS

- (a) Connaught Startup Award for tenure track faculty
  - Agency: University of Toronto
  - Amount: \$10,000 CAD
  - Date of award: September 2005
- (b) Alfred P. Sloan Fellowship
  - Agency: Alfred P. Sloan Foundation
  - Amount: \$45,000 USD
  - Date of award: March 2006
- (c) Discovery Grant
  - Agency: National Science and Engineering Research Council, Canada
  - Amount: \$40,378 CAD per year
  - Date of award: April 2006
  - Duration: Five years (2006-2011)
- (d) Early Researcher Award
  - Agency: Ministry of Research and Innovation, Ontario
  - Amount: \$100,000 CAD
  - Date of award: Sept. 2007
  - Duration: Five years (2007-2012)

## C. SCHOLARLY AND PROFESSIONAL WORK

### 1. REFEREED PUBLICATIONS

1. “**Polymers below the theta point: Renormalization group considerations**”: P. Biswas, A. Paramekanti, and B.J. Cherayil, *J. Chem. Phys.* **103**, 7562-7568 (1995).
2. “**Shapes of generalized random walks**”: P. Biswas, A. Paramekanti, and B.J. Cherayil, *J. Chem. Phys.* **104**, 3360-3365 (1996).
3. “**Upper bounds on the superfluid stiffness of disordered systems**”: A. Paramekanti, N. Trivedi and M. Randeria, *Phys. Rev. B* **58**, 11639-11647 (1998).
4. “**Metal-insulator transition and ferromagnetism in the electron doped layered manganites  $La_{2.3-x}Y_xCa_{0.7}Mn_2O_7$  ( $x=0,0.3,0.5$ )**”: P. Raychaudhuri,

C. Mitra, [A. Paramekanti](#), R. Pinto, A. K. Nigam and S. K. Dhar, *J. Phys.: Cond. Matt.* **10**, L191-L198 (1998).

5. **“Superconducting gap anisotropy and quasiparticle interactions: a doping dependent photoemission study”**: J. Mesot, M.R. Norman, H. Ding, M. Randeria, J.C. Campuzano, [A. Paramekanti](#), H.M. Fretwell, A. Kaminski, T. Takeuchi, T. Yokoya, T. Sato, T. Takahashi, T. Mochiku and K. Kadowaki, *Phys. Rev. Lett.* **83**, 840-843 (1999).

6. **“Effective actions and phase fluctuations in *d*-wave superconductors”**: [A. Paramekanti](#), M. Randeria, T.V. Ramakrishnan and S.S. Mandal, *Phys. Rev. B* **62**, 6786-6799 (2000).

7. **“Phase fluctuations, dissipation and superfluid stiffness in *d*-wave superconductors”**: L. Benfatto, S. Caprara, C. Castellani, [A. Paramekanti](#) and M. Randeria, *Phys. Rev. B* **63**, 174513 [1-9] (2001).

8. **“Experimental implications of quantum phase fluctuations in layered *d*-wave superconductors”**: [A. Paramekanti](#), *Phys. Rev. B* **65**, 104521 [1-6] (2002).

9. **“Projected wavefunctions and high temperature superconductivity”**: [A. Paramekanti](#), M. Randeria and N. Trivedi, *Phys. Rev. Lett.* **87**, 217002 [1-4] (2001).

10. **“Ring exchange, the exciton Bose liquid, and bosonization in two dimensions”**: [A. Paramekanti](#), L. Balents and M.P.A. Fisher, *Phys. Rev. B* **66**, 054526 [1-27] (2002).

11. **“Fermi liquid interactions and the superfluid density in *d*-wave superconductors”**: [A. Paramekanti](#) and M. Randeria, *Phys. Rev. B* **66**, 214517 [1-5] (2002).

12. **“XY ring-exchange model on the triangular lattice”**: L. Balents and [A. Paramekanti](#), *Phys. Rev. B* **67**, 134427 [1-8] (2003).

13. **“High  $T_c$  superconductivity: A variational theory of the superconducting state”**: [A. Paramekanti](#), M. Randeria and N. Trivedi, *Phys. Rev. B* **70**, 054504 [1-21] (2004).

14. **“Nodal quasiparticle dispersion in strongly correlated *d*-wave superconductors”**: M. Randeria, [A. Paramekanti](#), and N. Trivedi, *Phys. Rev. B* **69**, 144509 [1-5] (2004).

15. **“Extending Luttinger’s theorem to  $Z(2)$  fractionalized phases of matter”**: [A. Paramekanti](#) and A. Vishwanath, *Phys. Rev. B* **70**, 245118 [1-23] (2004).

16. **“Testing for topological order in variational wavefunctions for  $Z(2)$  spin liquids”**: [A. Paramekanti](#), M. Randeria and N. Trivedi, *Phys. Rev. B* **71**, 094421 [1-8] (2005).

17. **“Transition to zero resistance in a two dimensional electron gas driven with microwaves”**: J. Alicea, L. Balents, M.P.A. Fisher, [A. Paramekanti](#), and L. Radzihovsky, *Phys. Rev. B* **71**, 235322 [1-14] (2005).

18. **“Supersolid order from disorder: Hard-core bosons on the triangular lattice”**: R.G. Melko, [A. Paramekanti](#), A.A. Burkov, A. Vishwanath, D.N. Sheng, and L. Balents, *Phys. Rev. Lett.* **95**, 127207 [1-4] (2005).
19. **“Effect of multispin interactions on spin dynamics in the Neel state of  $\text{La}_2\text{CuO}_4$ ”**: L. Capriotti, A. Läuchli, [A. Paramekanti](#), *Phys. Rev. B* **72**, 214433 [1-8] (2005).
20. **“Excitations in correlated superfluids near a continuous transition into a supersolid”**: E. Zhao and [A. Paramekanti](#), *Phys. Rev. Lett.* **96**, 105303 [1-4] (2006).
21. **“BCS-BEC crossover on the two-dimensional honeycomb lattice”**: E. Zhao and [A. Paramekanti](#), *Phys. Rev. Lett.* **97**, 230404 (2006).
22. **“Spin liquid phase in a  $S = 1/2$  quantum magnet on the kagome lattice”**: S. V. Isakov, Yong Baek Kim, [A. Paramekanti](#), *Phys. Rev. Lett.* **97**, 207204 (2006).
23. **“SU(N) quantum spin models: A variational wavefunction study”**: [A. Paramekanti](#) and J. B. Marston, *J. Phys. Cond. Matt.* **19**, 125215 (2007), Special Issue on Correlated Electron Systems.
24. **“Temperature dependent Fermi arcs in the normal state of the underdoped cuprate superconductors”**: [A. Paramekanti](#) and E. Zhao, *Phys. Rev. B* (Rapid Communication), **75**, 140507 (2007).
25. **“Self-consistent slave rotor mean field theory for strongly correlated systems”**: E. Zhao and [A. Paramekanti](#), *Phys. Rev. B* **76**, 195101 (2007).
26. **“Exotic phase diagram of a cluster charging model of bosons on the kagome lattice”**: S. V. Isakov, [A. Paramekanti](#), Y.-B. Kim, *Phys. Rev. B* **76**, 224431 (2007).
27. **“Stability of Superflow for Ultracold Fermions in Optical Lattices”**: A. Burkov and [A. Paramekanti](#), *Phys. Rev. Lett.* **100**, 255301 (2008).

## 2. *NON-REFEREED PUBLICATIONS (CONFERENCE PROCEEDINGS)*

1. **“BSCCO superconductors: Hole-like Fermi surface and doping dependence of the gap function”**: J. Mesot, M.R. Norman, H. Ding, M. Randeria, J.C. Campuzano, [A. Paramekanti](#), H.M. Fretwell, A. Kaminski, T. Takeuchi, T. Yokoya, T. Sato, T. Takahashi, T. Mochiku and K. Kadowaki, *J. Low Temp. Phys.* **117** (3-4), 365-369 (1999).
2. **“Changes in superconducting gap anisotropy with doping and implications for the penetration depth”**: J. Mesot, M.R. Norman, H. Fretwell, A. Kaminski, J.-C. Campuzano, H. Ding, M. Randeria, [A. Paramekanti](#), T. Takeuchi, T. Mochiku, T. Yokoya, T. Sato, T. Takahashi and K. Kadowaki, *Int. J. Mod. Phys. B* **13**, 3709-3711 (1999).
3. **“Quasiparticles and phase fluctuations in high  $T_c$  superconductors”**: [A. Paramekanti](#) and M. Randeria, in Proceedings of the M2S-HTSC-VI conference (Houston), *Physica C* **341-348**, 827 (2000).

4. “**Superconductivity in Doped Mott Insulators**”: M. Randeria, A. Paramekanti and N. Trivedi, *Highlights in Condensed Matter Theory*, edited by M. Marinaro *et al.*, AIP Press (2003).
5. “**A Variational Wave Function Approach to High Tc Superconductivity**”: M. Randeria, A. Paramekanti and N. Trivedi, *Invited Contribution, Proceedings of the Seventh International Conference on Materials and Mechanisms of Superconductivity – High Tc Superconductivity (M2S Rio)*, Physica C (2003).
6. “**Temperature scaling of Fermi arcs in the normal state of the cuprate superconductors**”: E. Zhao and A. Paramekanti, submitted to *Proceedings of the Seventh International Conference on Strongly Correlated Electron Systems*, Houston (2007).

### 3. PAPERS PRESENTED AT MEETINGS

- (a) “A supersolid phase of hardcore bosons on the triangular lattice”, Short invited talk at the Conference on Quantum Clusters for Correlated Materials (Sherbrooke, July 2005).
- (b) “A supersolid phase of hardcore bosons on the triangular lattice”, Poster at the CIAR meeting on Quantum Materials (Waterloo, November 2005).
- (c) “Excitations in a superfluid close to a transition into a supersolid phase”, Poster at the CIAR meeting on Ultracold Atomic Gases (Banff, February 2006).
- (d) “Excitations in a superfluid close to a transition into a supersolid phase”, Poster at the Gordon Research Conference on Correlated Electron Systems (Mt. Holyoke, June 2006).
- (e) “Superconductivity on the honeycomb lattice: Semimetal-to-superconductor transition and BCS-BEC crossover”, Poster at the Gordon Research Conference on Correlated Electron Systems (Mt. Holyoke, June 2006).
- (f) “Superconductivity on the honeycomb lattice” Oral presentation at the APS March meeting (Denver, March 2007).

### 4. INVITED SEMINARS

- (a) “Supersolids, or how do bosons resolve their frustration?”, Colloquium, University of Toronto (September 2005).
- (b) “The supersolid phase of frustrated bosons” Colloquium, McMaster University (November 2005).
- (c) “Supersolids, or how do bosons resolve their frustration?”, Colloquium, University of Waterloo (January 2006).
- (d) “Vortices and rotons in a superfluid close to a supersolid phase transition”, Invited condensed matter seminar at the Physics Department, Harvard University (June 2006).
- (e) “Vortices and rotons in a superfluid close to a supersolid phase transition”, Invited condensed matter seminar at the Physics Department, Brown University (June 2006).

- (f) “Vortices and rotons in a superfluid close to a supersolid phase transition”, Invited seminar at the meeting of Canadian Association of Physicists (Brock University, St. Catherine’s, June 2006).
- (g) “Superconductors near quantum phase transitions - Ultracold atomic gases and high Tc cuprates”, Invited seminar, John’s Hopkins University (Baltimore, Dec. 2006).
- (h) “Superconductors near quantum phase transitions - Ultracold atomic gases and high Tc cuprates”, Invited seminar, Queen’s University (Kingston, Jan 2007).
- (i) “Overview of Hubbard models” - Invited talk at the CIAR Conference on Quantum Simulations using Ultracold Atoms (Vancouver, Feb 2007).
- (j) “Strong Correlation Effects in the Cuprates: Fermi Arcs and Tunneling Asymmetries” Invited talk at the CIAR Conference on Quantum Materials (Vancouver, May 2007).
- (k) “Fermi Arcs in the Underdoped High Tc Superconductors”, Invited seminar, SUNY Buffalo (Buffalo, Dec 2007).
- (l) “Overview of High Temperature Superconductivity” - Colloquium at Physics Department, University of Alberta, (Edmonton, Feb 2008).

## D. LIST OF COURSES

### 1. *UNDERGRADUATE COURSES*

- (a) Spring 2007: Quantum Mechanics (PHY291S) - 2nd Year Engg. Sci. (Coordinator)
- (b) Fall 2007: Electromagnetic Theory (PHY352F) - 3rd Year Physics
- (c) Spring 2008: Quantum Mechanics (PHY291S) - 2nd Year Engg. Sci. (Coordinator)
- (d) Fall 2008: Electromagnetic Theory (PHY352F) - 3rd Year Physics

### 2. *GRADUATE COURSES*

- (a) Spring 2006: Many Body Theory (PHY2321S) - Graduate course
- (b) Spring 2007: Many Body Theory (PHY2321S) - Graduate course
- (c) Fall 2008: Special Topics (PHY2313) - Magnetism

### 3. *SUPERVISION*

- (a) Masters student: Mr. Fazal Fallah Tafti (May-July 2006, Thesis title: “Boson-Fermion Mixtures in an Optical Lattice”)
- (b) Masters Student: Mr. Ganesh Ramachandran (2006 - 2007)
- (c) Doctoral student: Mr. Ganesh Ramachandran (September 2007 - )
- (d) Doctoral student: Mr. Matthew Killi (September 2007 - )
- (e) Postdoctoral fellow: Dr. Erhai Zhao (September 2005 - Sept 2007)
- (f) Postdoctoral fellow: Dr. Michael Lawler (September 2006 - Sept 2008)
- (g) Postdoctoral fellow: Dr. Daniel Podolsky (October 2007 - )
- (h) NSERC summer fellow: Mr. Mohammad Abdullah Al-Rashid (May-Aug 2008)
- (i) NSERC summer fellow: Mr. Andrew Mulder (May-Aug 2008)
- (j) Senior Year Thesis: Mr. Andrew Mulder (2008-2009)

### 4. *OTHER LECTURES*

- (a) Invited lectures on “Fractionalization and the Luttinger theorem”, Asia-Pacific Center for Theoretical Physics (Phoenix Park, South Korea, February 2005).

## E. ADMINISTRATIVE RESPONSIBILITIES

- 1. Undergraduate Curriculum Committee Member, Department of Physics (2005-2006)
- 2. Library Committee Member, Department of Physics (2005-2008)
- 3. Co-organizer, Condensed Matter Physics Seminar series (2005-2007)
- 4. Graduate Curriculum Committee Member, Department of Physics (2006-2007)

5. Colloquium Committee Member, Department of Physics (2006-2008)

6. Faculty Search Committee (Expt. Cond. Matt. Phys.) (2006-2007)

## **F. OTHER RELEVANT INFORMATION**