

# CURRICULUM VITAE

## A. BIOGRAPHICAL INFORMATION

### 1. *PERSONAL*

Name: ARUN PARAMEKANTI

Office Address: DEPARTMENT OF PHYSICS,  
UNIVERSITY OF TORONTO,  
MP 1006, MCLENNAN LABORATORY,  
60 ST. GEORGE STREET,  
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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, Government of Ontario (2007-2012).
- (d) Scholar (Quantum Materials Programme) of the Canadian Institute for Advanced Research (2009-)

### 5. *PROFESSIONAL AFFILIATIONS AND ACTIVITIES*

- (a) Referee: Physical Review Letters, Physical Review B.
- (b) Referee: Europhysics Letters.
- (c) Referee: Nature Physics.
- (d) Referee: Natural Sciences and Engineering Research Council of Canada
- (e) Referee: National Science Foundation, USA.

## 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.
- (b) Quantum magnets, superfluids, and supersolids on triangular and other lattice geometries with a view to understanding how geometric frustration influences the nature of the quantum ground state and low-energy excitations.
- (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) Connaught Foundation Grant
  - Agency: University of Toronto
  - Amount: \$30,000 CAD
  - Date of award: August 2006
- (d) Discovery Grant
  - Agency: Natural Sciences and Engineering Research Council, Canada
  - Amount: \$40,378 CAD per year
  - Date of award: April 2006
  - Duration: Five years (2006-2011)
- (e) 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) [7 pages].
2. “**Shapes of generalized random walks**”: P. Biswas, [A. Paramekanti](#), and B.J. Cherayil, *J. Chem. Phys.* **104**, 3360-3365 (1996) [6 pages].
3. “**Upper bounds on the superfluid stiffness of disordered systems**”: [A. Paramekanti](#), N. Trivedi and M. Randeria, *Phys. Rev. B* **58**, 11639-11647 (1998) [9 pages].
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) [8 pages].
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) [4 pages].
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) [14 pages].
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 (2001) [9 pages].
8. “**Experimental implications of quantum phase fluctuations in layered  $d$ -wave superconductors**”: [A. Paramekanti](#), *Phys. Rev. B* **65**, 104521 (2002) [6 pages].
9. “**Projected wavefunctions and high temperature superconductivity**”: [A. Paramekanti](#), M. Randeria and N. Trivedi, *Phys. Rev. Lett.* **87**, 217002 (2001) [4 pages].
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 (2002) [27 pages].
11. “**Fermi liquid interactions and the superfluid density in  $d$ -wave superconductors**”: [A. Paramekanti](#) and M. Randeria, *Phys. Rev. B* **66**, 214517 (2002) [5 pages].
12. “**XY ring-exchange model on the triangular lattice**”: L. Balents and [A. Paramekanti](#), *Phys. Rev. B* **67**, 134427 (2003) [8 pages].

13. **“High Tc superconductivity: A variational theory of the superconducting state”**: [A. Paramekanti](#), M. Randeria and N. Trivedi, *Phys. Rev. B* **70** 054504 (2004) [21 pages].
14. **“Nodal quasiparticle dispersion in strongly correlated d-wave superconductors”**: M. Randeria, [A. Paramekanti](#), and N. Trivedi, *Phys. Rev. B* **69**, 144509 (2004) [5 pages].
15. **“Extending Luttinger’s theorem to Z(2) fractionalized phases of matter”**: [A. Paramekanti](#) and A. Vishwanath, *Phys. Rev. B* **70**, 245118 (2004) [23 pages].
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 (2005) [8 pages].
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 (2005) [14 pages].
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 (2005) [4 pages].
19. **“Effect of multispin interactions on spin dynamics in the Neel state of La<sub>2</sub>CuO<sub>4</sub>”**: L. Capriotti, A. Läuchli, [A. Paramekanti](#), *Phys. Rev. B* **72**, 214433 (2005) [8 pages].
20. **“Excitations in correlated superfluids near a continuous transition into a supersolid”**: E. Zhao and [A. Paramekanti](#), *Phys. Rev. Lett.* **96**, 105303 (2006) [4 pages].
21. **“BCS-BEC crossover on the two-dimensional honeycomb lattice”**: E. Zhao and [A. Paramekanti](#), *Phys. Rev. Lett.* **97**, 230404 (2006) [4 pages].
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) [4 pages].
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) [4 pages].
25. **“Self-consistent slave rotor mean field theory for strongly correlated systems”**: E. Zhao and [A. Paramekanti](#), *Phys. Rev. B* **76**, 195101 (2007) [15 pages].
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) [10 pages].

27. **“Stability of Superflow for Ultracold Fermions in Optical Lattices”**: A. Burkov and [A. Paramekanti](#), Phys. Rev. Lett. **100**, 255301 (2008) [4 pages].
28. **“Gapless Spin Liquids on the 3D Hyper-Kagome Lattice of  $\text{Na}_4\text{Ir}_3\text{O}_8$ ”**: M. Lawler, [A. Paramekanti](#), Y.-B. Kim and L. Balents, Phys. Rev. Lett. **101**, 197202 (2008) [4 pages].
29. **“Multiband Superfluidity and Superfluid to Band-Insulator Transition of Strongly Interacting Fermions in an Optical Lattice”**: A. A. Burkov and [A. Paramekanti](#), Phys. Rev. A **79**, 043626 (2009) [5 pages].
30. **“Mott transition between a spin-liquid insulator and a metal in three dimensions”**: D. Podolsky, [A. Paramekanti](#), Y.-B. Kim and T. Senthil, Phys. Rev. Lett. **102**, 186401 (2009) [4 pages].
31. **“Microscopic theory of the nematic phase in  $\text{Sr}_3\text{Ru}_2\text{O}_7$ ”**: S. Raghu, [A. Paramekanti](#), E.-A. Kim, R. A. Borzi, S. Grigera, A. P. Mackenzie, and S. A. Kivelson, Phys. Rev. B **79**, 214402 (2009) [10 pages].
32. **“Repulsive Fermi gas in a harmonic trap: Ferromagnetism and Spin Textures”**: L. LeBlanc, J. H. Thywissen, A. A. Burkov, and [A. Paramekanti](#), Phys. Rev. A **80**, 013607 (2009) [10 pages].
33. **“Collective modes and superflow instabilities of strongly correlated Fermi superfluids”**: R. Ganesh, [A. Paramekanti](#), and A. A. Burkov, Phys. Rev. A **80**, 043612 (2009) [14 pages].
34. **“Finite Momentum Pairing Instability of Band Insulators with Multiple Bands”**: P. Nikolic, A. A. Burkov, and [A. Paramekanti](#), Phys. Rev. B **81**, 012504 (2010) [4 pages].
35. **“Supersolidity in the  $S=1/2$  triangular lattice XXZ model: A variational perspective”**: D. Heidarian and [A. Paramekanti](#), Phys. Rev. Lett. **104**, 015301 (2010) [4 pages].
36. **“Magnetic nature of the 500 meV peak in  $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$  observed with resonant inelastic x-ray scattering”**: D. S. Ellis, J. H. Kim, J. P. Hill, S. Wakimoto, R. J. Birgeneau, Y. Shvyd’ko, D. Casa, T. Gog, K. Ishii, K. Ikeuchi, [A. Paramekanti](#), and Y. J. Kim, Phys. Rev. B **81**, 085124 (2010) [12 pages].
37. **“Competing paramagnetic ground states of the Heisenberg model on the star lattice”**: B. J. Yang, [A. Paramekanti](#) and Y. B. Kim, Phys. Rev. B **81**, 134418 (2010) [23 pages].
38. **“Tunable Luttinger liquid physics in biased bilayer graphene”**: M. Killi, T.-C. Wei, I. Affleck, and A. Paramekanti, Phys. Rev. Lett. **104**, 216406 (2010) [4 pages].
39. **“Spiral order by disorder and lattice nematic order in a frustrated Heisenberg antiferromagnet on the honeycomb lattice”**: A. Mulder, R. Ganesh, L. Capriotti, and A. Paramekanti, Phys. Rev. B **81**, 214419 (2010) [10 pages].

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) [5 pages].
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 pages].
3. “**Quasiparticles and phase fluctuations in high Tc superconductors**”: A. Paramekanti and M. Randeria, in Proceedings of the M2S-HTSC-VI conference (Houston), *Physica C* **341-348**, 827 (2000) [8 pages].
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”, Poster at the CIAR meeting on Quantum Materials (Waterloo, November 2005).
- (b) “Excitations in a superfluid close to a transition into a supersolid phase”, Poster at the CIAR meeting on Ultracold Atomic Gases (Banff, February 2006).
- (c) “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).
- (d) “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).
- (e) “Superconductivity on the honeycomb lattice” Oral presentation at the APS March meeting (Denver, March 2007).
- (f) “Dynamical Instabilities of Cold Fermi Superfluids” Oral presentation at the Aspen Workshop on Vortices and Fluctuations in Superconductors (Aspen, July 2009).

### 4. INVITED SEMINARS AND PRESENTATIONS

- (a) Invited lectures on “Fractionalization and the Luttinger theorem”, Asia-Pacific Center for Theoretical Physics (Phoenix Park, South Korea, February 2005).
- (b) “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).
- (c) “Supersolids, or how do bosons resolve their frustration?”, Colloquium, University of Toronto (September 2005).
- (d) “The supersolid phase of frustrated bosons” Colloquium, McMaster University (November 2005).
- (e) “Supersolids, or how do bosons resolve their frustration?”, Colloquium, University of Waterloo (January 2006).
- (f) “Vortices and rotons in a superfluid close to a supersolid phase transition”, Invited condensed matter seminar at the Physics Department, Harvard University (June 2006).
- (g) “Vortices and rotons in a superfluid close to a supersolid phase transition”, Invited condensed matter seminar at the Physics Department, Brown University (June 2006).
- (h) “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).



- (i) “Superconductors near quantum phase transitions - Ultracold atomic gases and high Tc cuprates”, Invited seminar, John’s Hopkins University (Baltimore, Dec. 2006).
- (j) “Superconductors near quantum phase transitions - Ultracold atomic gases and high Tc cuprates”, Invited seminar, Queen’s University (Kingston, Jan 2007).
- (k) “Overview of Hubbard models” - Invited talk at the CIAR Conference on Quantum Simulations using Ultracold Atoms (Vancouver, Feb 2007).
- (l) “Strong Correlation Effects in the Cuprates: Fermi Arcs and Tunneling Asymmetries” Invited talk at the CIAR Conference on Quantum Materials (Vancouver, May 2007).
- (m) “Fermi Arcs in the Underdoped High Tc Superconductors”, Invited seminar, SUNY Buffalo (Buffalo, Dec 2007).
- (n) “Overview of High Temperature Superconductivity” - Colloquium at Physics Department, University of Alberta, (Edmonton, Feb 2008).
- (o) “Superfluid insulator transition of Cold Fermi gases”- Seminar at Raman Research Institute (Bangalore, Jan 2009), Indian Institute of Science (Bangalore, Feb 2009), University of Pittsburgh (Dec 2008)
- (p) “Superfluidity and Ferromagnetism of Cold Fermi gases” - Seminar at Caltech, UCLA, UC Riverside (May 2009)
- (q) “Variational Monte Carlo studies of strongly correlated systems”, Condensed Matter School, International School of Theoretical Studies (Mahabaleshwar, India - Dec 2009).

## 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
- (e) Spring 2009: Quantum Mechanics (PHY291S) - 2nd year Engg. Sci. (Coordinator)
- (f) Fall 2009: Electromagnetic Theory (PHY350H) - 3rd Year Physics
- (g) Fall 2009: Physics for the Life Sciences (PHY231H) - Bio, Phy Minors
- (h) Spring 2010: Quantum Mechanics (PHY294S) - 2nd year Engg. Sci. (Coordinator)

## 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 - Magnetism (PHY2313F)

## 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) Postdoctoral Fellow: Dr. Dariush Heidarian (October 2008-)
- (i) NSERC summer fellow: Mr. Andrew Mulder (May-Aug 2008)
- (j) NSERC summer fellow: Mr. Abdullah Al-Rashid (May-Aug 2008)
- (k) Senior Thesis: Engineering Science, Mr. Andrew Mulder (Sept 2008 - April 2009)

## E. ADMINISTRATIVE RESPONSIBILITIES

- 1. Undergraduate Curriculum Committee Member, Department of Physics (2005-2006,2009-2010)
- 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)
- 7. Graduate Curriculum Committee (2008-2010)
- 8. Standards and Evaluation Committee (2008-2010)

## F. OTHER RELEVANT INFORMATION