

# Ehsan Khatami

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San Jose State University  
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## EDUCATION

**Ph.D. in Physics**, University of Cincinnati, Cincinnati, OH (2009)

Thesis: “*Criticality and Superconductivity in the Two-dimensional Hubbard Model of Strongly Correlated Electronic Systems*”

Adviser: Prof. Mark Jarrell

**Master of Science in Physics**, Sharif University of Technology, Tehran, Iran (2004)

Thesis: “*Transport Properties of Carbon Nanotubes*”

Adviser: Prof. Keivan Esfarjani

**Bachelor of Science in Physics**, Isfahan University of Technology, Isfahan, Iran (2001)

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## ACADEMIC POSITIONS

**Assistant Professor**

*Department of Physics & Astronomy, San Jose State University*

August 2014 - present

**Postdoctoral Scholar**

Supervisors: Profs. Richard Scalettar and Rajiv R. P. Singh

*Department of Physics, University of California, Davis*

July 2013 - August 2014

**Visiting Research Scholar**

Supervisor: Prof. B. Sriram Shastry

*Department of Physics, University of California, Santa Cruz*

September 2012 - Present

**Postdoctoral Fellow**

Supervisor: Prof. Marcos Rigol

*Department of Physics, Georgetown University*

September 2009 - June 2013

**Research Assistant (Graduate Student)**

Supervisor: Prof. Mark Jarrell

*Department of Physics and Astronomy, Louisiana State Univ.*

January - August 2009

*Department of Physics, University of Cincinnati*

September 2006 - December 2008

**Research Assistant (Graduate Student)**

Supervisor: Prof. Keivan Esfarjani

*Department of Physics, Sharif University of Technology*

September 2002 - September 2004

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## SHORT TERM VISITS

Kavli Institute for Theoretical Physics  
University of California, Santa Barbara

June 22 - July 3, 2015

Program: “*Workshop for Theorists at Undergraduate Institutions*”

Kavli Institute for Theoretical Physics  
University of California, Santa Barbara August 20 - September 7, 2012  
Program: “*Quantum Dynamics in Far from Equilibrium Thermally Isolated Systems*”  
At the same time, benefited greatly from “*Frustrated Magnetism and Quantum Spin Liquids*”

Department of Physics, University of California, Santa Cruz April 16 - May 16, 2012  
Visiting Prof. Sriram Shastry

Kavli Institute for Theoretical Physics  
University of California, Santa Barbara November 15 - December 17, 2010  
Program: “*Disentangling Quantum Many-body Systems: Computational and Conceptual Approaches*”

Institute for Theoretical Physics  
University of Göttingen, Göttingen, Germany July 16 - August 17, 2007  
Visiting Prof. Thomas Pruschke

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## RESEARCH INTERESTS

- Strongly correlated electronic systems
- Ultracold atoms in optical lattices
- Quantum non-equilibrium dynamics of isolated many-body systems
- Frustrated magnetism
- Numerical methods in condensed matter physics

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## EXTERNAL GRANTS (SUPERCOMPUTER RESOURCES)

- 433,771 Service Units (SUs) on Xsede Supercomputers, Project No.: DMR150010, April 2015  
“*Studying quantum lattice models of strongly-correlated electrons using numerical linked-cluster expansions*”, dollar value: \$30,230,  
**E. Khatami** (PI)
  - 150,000 SUs on Xsede Supercomputers, Project No.: DMR130143, October 2013  
“*Systematic study of superconductivity in the Hubbard model*”,  
**E. Khatami** (co-PI), and Rajiv R. P. Singh (co-PI)
  - 200,000 SUs on Teragrid Supercomputers, Project No.: DMR100026, January 2010  
“*Numerical Linked-Cluster algorithms for frustrated and inhomogeneous quantum-mechanical systems*”  
**E. Khatami** (PI)
  - 498,000 SUs on Teragrid Supercomputers, Project No.: DMR-070031 (renewal), April 2008  
“*Simulations employing the dynamical cluster approximation*”,  
A. Macridin, C. Şen, K. Mielsons, **E. Khatami**, H. Fotsos, M. Jarrell (PI), K. Tomko, M. A. Majidi, and J. Moreno
  - 495,000 SUs on Teragrid Supercomputers, Project No.: DMR-070031 (renewal), April 2007  
“*Simulations employing the dynamical cluster approximation*”,  
A. Macridin, K. Mielsons, **E. Khatami**, M. Jarrell (PI), K. Tomko, R. T. Scalettar, M. A. Majidi, J. Moreno, T. P. Devereaux, and B. Moritz
  - 10,000 Resource Units, the Ohio Supercomputer Center, November 2006  
“*Using DCA for Hubbard model with long-range hoppings/interpolation properties of the selfenergy*”,  
M. Jarrell (PI) and **E. Khatami**
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## TEACHING EXPERIENCES

- Teacher** (San Jose State University)  
Electricity and magnetism (LD), Thermodynamics & statistical mechanics (UD) Spring 2015  
Computational methods in physics (UD), Electricity and magnetism lab (LD) Fall 2015
- Lecturer**, Math methods and Quantum mechanics I (graduate)  
As a substitute for Prof. Rigol, taught in various occasions per semester throughout my postdoc.  
*Georgetown University* 2010 - 2012
- Instructor**, Mechanics tutorials  
Facilitated inquiry-based activities and the cooperative learning of students during each session.  
*Georgetown University* Fall 2010
- Teaching Assistant** Quantum mechanics, Electrodynamics (graduate),  
Statistical Mechanics (graduate), College physics II, and Electromagnetism  
*University of Cincinnati* Fall 2004 - Spring 2006
- Instructor**, General physics lab II  
*University of Cincinnati* Winter 2006
- Instructor**, General physics lab I & II  
*Sharif University of Technology* Fall 2002 - Spring 2004
- Teaching Assistant**, Quantum mechanics  
*Isfahan University of Technology* Winter 2000
- Instructor**, General physics lab (I)  
*Isfahan University of Technology* Fall 2000
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## COMPUTER SKILLS

- Proficient in programming with Fortran 90-95
  - Proficient in parallel structuring and parallel programming with MPI and OpenMP
  - Practical experience in programming with Python, C, and Shell Script
  - In depth practical experience with Mathematica, L<sup>A</sup>T<sub>E</sub>X, Grace, Gnuplot, and MS-Office
  - In depth practical experience with Linux, Mac, and Windows operating systems
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## PUBLICATIONS

### Preprints:

29. **V. Iglovikov, E. Khatami, R. M. Fye, and R. T. Scalettar**  
*“Geometry dependence of the sign problem”*  
Phys. Rev. B (in press); arXiv:1501.02832

### Peer-Reviewed Journals:

28. **E. Khatami, R. T. Scalettar, and R. R. P. Singh**  
*“Finite-temperature superconducting correlations of the Hubbard model”*  
Phys. Rev. B **91**, 241107(R) (2015); arXiv:1503.06213
27. **R. A. Hart, P. M. Duarte, T.-L. Yang, X. Liu, T. Paiva, E. Khatami, R. T. Scalettar, N. Trivedi, D. A. Huse, and R. G. Hulet**  
*“Observation of antiferromagnetic correlations in the Hubbard model with ultracold atoms”*  
Nature **519**, 211-214 (2015); arXiv:1407.5932

26. **P. M. Duarte, R. A. Hart, T.-L. Yang, X. Liu, T. Paiva, E. Khatami, R. T. Scalettar, N. Trivedi, and R. G. Hulet**  
*“Compressibility of a fermionic Mott insulator of ultracold atoms”*  
 Phys. Rev. Lett. **114**, 070403 (2015); arXiv:1409.8348
25. **E. Khatami, R. R. P. Singh, W. E. Pickett, R. T. Scalettar**  
*“Magnetic correlations and pairing in the 1/5-depleted square lattice Hubbard model ”*  
 Phys. Rev. Lett. **113** (2014), 106402; arXiv:1404.3731
24. **E. Khatami, E. Perepelitsky, M. Rigol, and B. S. Shastry**  
*“Linked-cluster expansion for the Green’s function of the infinite-U Hubbard model”*  
 Phys. Rev. E **89**, 063301 (2014); arXiv:1310.8029
23. **B. Tang, T. Paiva, E. Khatami and M. Rigol**  
*“Finite-temperature properties of strongly correlated fermions in the honeycomb lattice”*  
 Phys. Rev. B **88**, 125127 (2013); arXiv:1307.1707.
22. **E. Khatami, G. Pupillo, M. Srednicki, and M. Rigol**  
*“Fluctuation-dissipation theorem in an isolated system of quantum dipolar bosons after a quench”*  
 Phys. Rev. Lett. **111**, 050403 (2013); arXiv:1304.7279.
21. **E. Khatami, D. Hansen, E. Perepelitsky, M. Rigol, B. S. Shastry**  
*“Electronic spectral properties of two-dimensional infinite-U Hubbard model”*  
 Phys. Rev. B **87**, 161120(R) (2013); arXiv:1303.2657.
20. **B. Tang, T. Paiva, E. Khatami and M. Rigol**  
*“Short-range correlations and cooling of ultracold fermions in the honeycomb lattice”*  
 Phys. Rev. Lett. **109**, 205301 (2012); arXiv:1206.0006.
19. **B. Tang, E. Khatami and M. Rigol**  
*“A short introduction to numerical linked-cluster expansions”*  
 Computer Physics Communications, **184**, 557 (2013); arXiv:1207.3366.
18. **E. Khatami and M. Rigol**  
*“Effect of particle statistics in strongly-correlated two-dimensional Hubbard models”*  
 Phys. Rev. A **86**, 023633 (2012); arXiv:1204.1556.
17. **E. Khatami, M. Rigol, A. Relaño, and A. M. Garcia-Garcia**  
*“Quantum quenches in disordered systems: approach to thermal equilibrium without a typical relaxation time”*  
 Phys. Rev. E **85**, 050102(R) (2012); arXiv:1103.0787.
16. **E. Khatami, J. S. Helton, and M. Rigol**  
*“Numerical study of the thermodynamics of clinoatacamite”*  
 Phys. Rev. B **85**, 064401 (2012); arXiv:1102.0777.
15. **E. Khatami, R. R. P. Singh, and M. Rigol**  
*“Thermodynamics and phase transitions for the Heisenberg model on the pinwheel distorted kagome lattice”*  
 Phys. Rev. B **84**, 224411 (2011); arXiv:1105.4147.
14. **E. Khatami and M. Rigol**  
*“Thermodynamics of strongly interacting fermions in two-dimensional optical lattices”*  
 Phys. Rev. A **84**, 053611 (2011); arXiv:1104.5494.
13. **E. Khatami and M. Rigol**  
*“Thermodynamics of the antiferromagnetic Heisenberg model on the checkerboard lattice”*  
 Phys. Rev. B **83**, 134431 (2011); arXiv:1009.4700.
12. **S.-X. Yang, H. Fotso, S.-Q. Su, D. Galanakis, E. Khatami, J.-H. She, J. Moreno, J. Zaanen, and M. Jarrell**  
*“Proximity of the superconducting dome and the quantum critical point in the two-dimensional*

*Hubbard model*

Phys. Rev. Lett. **106**, 047004 (2011); arXiv:1101.6050.

11. **D. Galanakis, E. Khatami, K. Mikelsons, A. Macridin, J. Moreno, D. A. Browne, and M. Jarrell**  
“*Quantum criticality and incipient phase separation in the thermodynamic properties of the Hubbard model*”  
Philosophical Transactions of the Royal Society A, **369**, 1670 (2011); arXiv:1009.2563.
10. **E. Khatami, K. Mikelsons, D. Galanakis, A. Macridin, J. Moreno, R. T. Scalettar, and M. Jarrell**  
“*Quantum criticality due to incipient phase separation in the two-dimensional Hubbard model*”  
Phys. Rev. B **81**, 201101(R) (2010); arXiv:0909.0759.
9. **E. Khatami, C. R. Lee, Z. J. Bai, R. T. Scalettar and M. Jarrell**  
“*Cluster solver for dynamical mean-field theory with linear scaling in inverse temperature*”  
Phys. Rev. E **81**, 056703 (2010); arXiv:0904.1239.
8. **K. Mikelsons, E. Khatami, D. Galanakis, A. Macridin, J. Moreno, and M. Jarrell**  
“*Thermodynamics of the quantum critical point at finite doping in the two-dimensional Hubbard model studied via dynamical cluster approximation*”  
Phys. Rev. B **80**, 140505(R) (2009); arXiv:0909.0498.
7. **E. Khatami, A. Macridin and M. Jarrell**  
“*Validity of spin-susceptibility glue approximation for pairing in the two-dimensional Hubbard model*”  
Phys. Rev. B **80**, 172505 (2009); arXiv:0901.4802.
6. **E. Khatami, A. Macridin and M. Jarrell**  
“*Effect of long-range hopping on  $T_c$  in a two-dimensional Hubbard-Holstein model of the cuprates*”  
Phys. Rev. B **78**, 060502(R) (2008); arXiv:0806.3996.

#### Book Chapters and Conference Proceedings:

5. **E. Khatami, G. Pupillo, M. Srednicki, and M. Rigol**  
“*Fluctuation-dissipation theorem in isolated quantum systems out of equilibrium*”  
Proceedings of the “Conference on Computational Physics 2013”, Moscow, Russia, August 20 - 24,  
J. Phys.: Conf. Ser. **510** 012035 (2014)
  4. **E. Khatami and M. Rigol**  
“*Numerical linked-cluster expansion for the distorted kagome lattice Heisenberg model*”  
Proceedings of the “Conference on Computational Physics 2011”, Gatlinburg, TN, October 30 -  
November 3, J. Phys.: Conf. Ser. **402** 012018 (2012)
  3. **E. Khatami and M. Rigol**  
“*Accessing the Mott regime in 2D optical lattices with strongly interacting fermions*”  
Proceedings of the international workshop “1<sup>st</sup> Centennial of Superconductivity: Trends on Nanoscale  
Superconductivity and Magnetism”, Cali, Colombia, June 29 - July 1, 2011,  
Journal of Superconductivity and Novel Magnetism, Vol. **25**, No. 7, 2145 (2012)
  2. **H. Fotso, S. Yang, K. Chen, S. Pathak, J. Moreno, M. Jarrell, K. Mikelsons, E. Khatami, and D. Galanakis**  
“*Dynamical Cluster Approximation*” in *Strongly Correlated Systems: Theoretical Methods*, Edited  
by Adolfo Avella and Ferdinando Mancini, Springer (November 28, 2011)
  1. **C.-R. Lee, S. Chiesa, C. N. Varney, E. Khatami, Z. Bai, E. D’Azevedo, M. Jarrell, Th. Maier, S. Savrasov, R. T. Scalettar, and K. Tomko**  
“*QUEST: QUantum Electron Simulation Toolbox*”  
Submitted to the Journal of Physics: Conference Series, Proceedings of SciDAC 2010
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## PRESENTATIONS

### Invited Talks:

15. Workshop for Theorists at Undergraduate Institutions, Kavli Institute for Theoretical Physics, University of California, Santa Barbara, CA, July 2, 2015  
*“Numerical approaches for strongly-correlated electronic systems”*
14. Mardi Gras Conference, Louisiana State University, Baton Rouge, LA, February 13, 2015  
*“Numerical linked-cluster expansion approach for strongly-correlated electronic systems”*
13. San Jose State University, San Jose, CA, March 13, 2014  
*“Strongly correlated lattice electrons; materials for tomorrow’s technology”*
12. APS March Meeting 2013, Baltimore, MD, March 21, 2013  
*“Dynamics and description after relaxation of disordered quantum systems after a sudden quench”*
11. University of California, Santa Cruz, April 27, 2012  
*“Thermodynamics and quantum phase transitions of frustrated magnets”*
10. Cornell University, Ithaca, NY, February 15, 2012  
*“Thermodynamic properties and phase transitions of frustrated magnets”*
9. University of Maryland, College Park, MD, February 3, 2012  
*“Thermodynamic properties and quantum phase transitions of frustrated magnets”*
8. George Mason University, Fairfax, VA, January 20, 2012  
*“Finite-temperature properties and phase transitions of frustrated magnets”*
7. National Institute of Standards and Technology (NIST), Gaithersburg, MD, December 1, 2011  
*“Phase transitions and finite-temperature properties of frustrated magnetic systems”*
6. University of California, Davis, December 10, 2010  
*“Thermodynamics of the AF Heisenberg model on the checkerboard lattice, studied via numerical linked-cluster expansions”*
5. Rutgers University, Piscataway, NJ, May 29, 2009  
*“Simulations of the Hubbard model for cuprates using Dynamical Cluster Approximation”*
4. Louisiana State University, Baton Rouge, LA, February 18, 2009  
*“The validity of the pairing “glue” in the 2D Hubbard model”*
3. University of California, Davis, CA, July 1, 2008  
*“Employing determinantal quantum Monte Carlo as a cluster solver for the dynamical cluster approximation”*
2. University of Southern California, Los Angeles CA, December 10, 2007  
*“Superconducting properties of the Hubbard model for cuprates”*
1. University of Göttingen, Göttingen, Germany, August 2007  
*“The effect of phonons and long-range hoppings on  $T_c$  in cuprates”*

### Contributed Talks:

15. APS March Meeting 2015, San Antonio, TX  
*“Strongly-correlated fermions on the 1/5-depleted square lattice”*
14. APS March Meeting 2015, San Antonio, TX  
*“Geometry dependence of the sign problem”*
13. APS March Meeting 2014, Denver, CO  
*“Finite-temperature superconducting correlations in the square lattice Hubbard model”*

12. Conference on Computational Physics, August 2013, Moscow, Russia  
*"Fluctuation-dissipation theorem in isolated quantum systems out of equilibrium"*
11. APS March Meeting 2013, Baltimore, MD  
*"Series expansion for the Green's function of the infinite-U Hubbard model"*
10. APS March Meeting 2012, Boston, MA  
*"Thermodynamics and phase transitions of the pinwheel distorted kagome lattice Heisenberg model"*
9. Conference on Computational Physics, Gatlinburg, TN, November 2, 2011  
*"Thermodynamics and phase transitions in the pinwheel distorted kagome lattice Heisenberg model"*
8. 1<sup>st</sup> Centennial of Superconductivity: Trends on Nanoscale Superconductivity and Magnetism international workshop, Cali, Colombia, June 30, 2011  
*"Thermodynamics of strongly interacting fermions in 2D optical lattices"*
7. APS March Meeting 2011, Dallas, TX  
*"Thermodynamics of the AF Heisenberg model on the checkerboard lattice"*
6. APS March Meeting 2010, Portland, OR  
*"Quantum criticality due to incipient phase separation in the 2D Hubbard model"*
5. APS March Meeting 2009, Pittsburgh, PA  
*"A linear-in-beta solver for cluster extensions of dynamical mean field theory"*
4. SciDac meeting, Ohio Supercomputer Center, Columbus, OH, September 2008  
*"DQMC as a cluster solver for the dynamical cluster approximation"*
3. APS March Meeting 2008, New Orleans, LA  
*"The 'glue' approximation for pairing interaction in the Hubbard model"*
2. APS March Meeting 2007, Denver, CO  
*"DCA results for the effect of long-range hoppings on  $T_c$  in cuprates"*
1. APS March Meeting 2006, Baltimore, MD  
*"Interaction of Zhang-Rice singlets with the buckling phonons in cuprates"*

**Posters:**

2. Symposium on Frontiers of Quantum Matter, George Mason University, Center for Quantum Science, Fairfax, VA, June 22, 2012  
*"Thermodynamic properties of distorted kagome lattices"*
1. Highly Frustrated Magnetism 2010, Baltimore, MD, August 2010  
*"Thermodynamics of the antiferromagnetic Heisenberg model on the checkerboard lattice"*

## OTHER CONFERENCES AND WORKSHOPS

- *Peter Young Retirement Conference*, University of California, Santa Cruz, CA, Feb 7 & 8, 2015
- *AAPT New Faculty Workshop*, American Center for Physics, College Park, MD, Nov 13-16, 2014
- *Center for Astronomy & Physics Education Research Workshop*, City College of San Francisco, CA, Oct 17 & 18, 2014
- Conference on *"Dynamics and Thermodynamics in Isolated Quantum Systems"*, Kavli Institute for Theoretical Physics, University of California, Santa Barbara, Aug 20-24, 2012
- Tutorial on *"Many-Body Systems of Ultracold Atoms"*, March Meeting 2012, Boston, MA
- Tutorial on *"Topological Insulators"*, March Meeting 2010, Portland, OR

- Workshop on “*Parallel programming with OpenMP*”, Ohio Supercomputer Center, Columbus, OH, Spring 2007
  - Workshop on “*Parallel programming with MPI*”, Miami University, Oxford, OH, presented by Ohio Supercomputer Center, Spring 2006
  - Workshop on “*C programming*”, Department of Physics, University of Cincinnati, presented by Ohio Supercomputer Center, Spring 2005
  - “*Winter school on special subjects in physics*”, Institute for Advance Studies in Basic Science (IASBS), Zanjan, Iran, Winter 2001
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## HONORS AND AWARDS

- Ranked 1<sup>st</sup> in a nationwide Master of Science entrance exam in physics for private (Azad) universities, held among approximately 4000 undergraduate physics students, Iran (2004)
  - Ranked 10<sup>th</sup> in the Master of Science National Entrance Exam in physics for state universities, held among approximately 5000 undergraduate students, Iran (2001)
  - Ranked 11<sup>th</sup> in the Sixth National Student Olympiad in Physics, Iran (2001)
  - Awarded a fellowship, providing supplemental financial support during undergraduate studies, Isfahan University of Technology, Iran (1999)
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## SERVICES

- Faculty advisor to the Physics Club, San Jose State University, Fall 2014 - present.
- Served in Department’s curriculum and space committees, San Jose State University, Fall & Spring 2014 - 2015.
- Served as a reviewer for the Department of Energy.
- Served as a referee for Physical Review Letters and Physical Review B.
- Chaired a Focus Session on “*Low D/Frustrated Magnetism - 2D Lattices*” at the APS March Meeting, Dallas, TX, 2011.