

KEITH R. FRATUS

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Department of Physics, UCSB

Santa Barbara, CA 93106

EDUCATION

University of California, Santa Barbara, Santa Barbara, CA
Ph.D. in Physics with Certificate in College and University Teaching (CCUT)
M.A. in Physics awarded March 2014

September 2010 - June 2017

University of Massachusetts, Amherst, Amherst, MA
Double B.S., Physics and Mathematics
Departmental Honors in Physics

January 2006 - May 2010

RESEARCH

University of California, Santa Barbara
Physics Department

June 2012 - Present

I currently study the thermalization of quantum systems, in particular the validity of the eigenstate thermalization hypothesis (ETH), under the advising of Professor Mark Srednicki. A large portion of my recent work has focused on the compatibility of eigenstate thermalization and spontaneous symmetry breaking. Mark and I are also interested in the onset of quantum chaos in systems perturbed away from integrability. Prior to this (before May 2013) I performed some work on the subject of topological insulators for Professor Andreas Ludwig. My research is partially funded by an NSF grant awarded to Mark Srednicki.

University of Massachusetts, Amherst
Physics Department

September 2008 - June 2010

While at UMass, I was a member of the Borexino Solar Neutrino Collaboration, under the advising of Professor Laura Cadonati. My research involved the application of various machine learning techniques, including Boosted Decision Trees, to the problem of removing background noise from the Borexino detector. I also participated in data collection on site at the Gran Sasso National Laboratory. This research led to an undergraduate thesis as part of the requirements for my departmental honors in Physics. My research was partially funded by an NSF grant awarded to Laura Cadonati.

PUBLICATIONS

1. K. R. Fratus, M. Srednicki, “Eigenstate thermalization and spontaneous symmetry breaking in the one-dimensional transverse-field Ising model with power-law interactions,” arXiv:1611.03992 [cond-mat.stat-mech], *submitted to Phys. Rev. E on December 2nd, 2016*
2. R. Mondaini, K. R. Fratus, M. Srednicki, M. Rigol, “Eigenstate thermalization in the two-dimensional transverse field Ising model,” *Phys. Rev. E* **93**, 032104 (2016) arXiv:1512.04947 [cond-mat.stat-mech]
3. K. R. Fratus, M. Srednicki, “Eigenstate Thermalization in Systems with Spontaneously Broken Symmetry,” *Phys. Rev. E* **92** (Rapid Communication), 040103 (2015), arXiv:1505.04206 [cond-mat.stat-mech]

INVITED TALKS

“Isolated Quantum Thermalization”:

1. Many Body Seminar at UCSB (Santa Barbara, CA), *May 2014*
2. Weld Collaboration Group Meeting at UCSB (Santa Barbara, CA), *October 2014*

“Muon Tagging with Boosted Decision Trees in Mach4”:

2. Borexino General Meeting at Princeton University (Princeton, NJ), *June 2010*

CONTRIBUTED TALKS

“Muon Background Removal in the Borexino Solar Neutrino Experiment”:

1. Syracuse University Undergraduate Research Day, Syracuse University (Syracuse, NY), *November 2009*
2. Five College Student Physics Symposium, Smith College (Northampton, MA, USA), *October 2009*

NOTABLE AWARDS AND FELLOWSHIPS

University of California, Santa Barbara

1. Doctoral Scholars Fellow, *March 2010*: A campus-wide fellowship awarded to select incoming graduate students who demonstrate outstanding promise
2. Yzurdiaga Fellowship, *June 2011*: Awarded by the Physics department for demonstrating outstanding scholastic achievement and research promise in Physics
3. Department of Physics Broida Fellowship, *February 2010*: Awarded by the Physics department to select incoming graduate students who demonstrate outstanding promise
4. Center for Science and Engineering Partnerships (CSEP) Excellence in Mentoring Award, *May 2017*: Awarded for my “outstanding contributions to undergraduate education,” largely for my role in developing the Physics program and mentoring undergraduate students in the Summer Institute for Mathematics and Science (SIMS) program

University of Massachusetts, Amherst

5. William F. Field Alumni Scholarship, *April 2009*: A campus-wide scholarship awarded to the top 60 students in each junior class at UMass Amherst (out of a junior class of 4,425 students)
6. LeRoy F. Cook, Jr. Memorial Scholarship, *May 2009*: A scholarship awarded by the UMass Amherst Physics Department for academic achievement and service to the department.
7. Chang Freshman Physics Award, *May 2007*: Presented by the Physics department to a member of the freshman physics class for academic excellence (shared with one other recipient)

ADDITIONAL AWARDS AND FELLOWSHIPS

University of California, Santa Barbara

1. Chair’s Outstanding Service Award, *May 2014*: Awarded to students for outstanding service to the Physics Department, in particular for my leading role in coordinating student life activities on campus

University of Massachusetts, Amherst

2. Runner-Up for Best Technical Paper, *May 2009*: An award bestowed by UMass Amherst’s Writing Department as part of their 2009 “Best Text Contest”
3. Phi Kappa Phi Certificate for Academic Excellence, *April 2008*: Awarded to the top 5% of each sophomore class
4. Engineering Scholarship Award, *Fall 2006*: A merit-based scholarship for students in the college of Engineering (awarded prior to change of major)
5. On Dean’s List for nine consecutive semesters, *Spring 2006 - Spring 2010*: Awarded to all students who attain an overall semester GPA of 3.5 or higher.

TEACHING EXPERIENCE

University of California, Santa Barbara

Mentor to Undergraduate Student

February 2016 - present

I have been directly mentoring an undergraduate student, Syrian Truong, in the subject of Quantum Monte Carlo and Stochastic Series Expansion, as applied to the study of transverse field Ising models with long-range interactions. We have a brief report regarding the thermodynamics of this system to be published on the arXiv soon.

Teaching Associate for Physics 103 (Intermediate Mechanics)

June-August 2015

I was the instructor of record for Physics 103, the second in a three-part mechanics sequence, intended for Junior Physics majors. Topics included Newton’s Laws, Drag, Conservation Laws, Oscillations (Simple, Damped, Driven, and Non-linear), Fourier Analysis and Green’s Functions, Gravitation, The Two-Body Problem, Scattering and Cross Sections, and Special Relativity.

Teaching Associate for Physics 6C & 6CL (Introductory Physics with Lab)

June-August 2014

I was the instructor of record for Physics 6C, the third in a three-course introductory physics sequence aimed primarily at life science majors.

Summer Teaching Institute for Associates (STIA)

Summer 2014

I completed the STIA program, which provides graduate student instructors (Associates) with a teaching orientation that is based on principles of interactive, collaborative learning, and designed to assist Associates with the planning, conduct and assessment of summer undergraduate courses at UCSB.

SIMS (Summer Institute in Mathematics and Science)

August 2013, 2014, 2015 & 2016

I was the upper-level physics instructor for the SIMS program, a two-week intensive program for advanced incoming Freshmen in the STEM disciplines.

TA Positions

Summer 2011 - Fall 2013

Phys 6BL, 6CL, 100A, 103, 115C, 121A (twice), 121B (twice), 215A, 220; CCS 140

MISCELLANEOUS EXPERIENCE

University of California, Santa Barbara

Creator and Leader of the Physics Department Many Body Journal Club, *March 2013 - September 2015*

Member of the Physics GradLife committee, *Fall 2012 - Summer 2014*

University of Massachusetts, Amherst

President of the Society for Physics Students, *Fall 2008 - Spring 2009*

Member of Commonwealth Honors College, *Spring 2007 - Spring 2010*

OTHER PROGRAMS, SCHOOLS, AND CONFERENCES ATTENDED

1. Designer Quantum Systems out of Equilibrium, Kavli Institute for Theoretical Physics, *Fall 2016*
2. Many-Body Localization, Kavli Institute for Theoretical Physics, *Fall 2015*
3. Entanglement in Strongly-Correlated Quantum Matter, Kavli Institute for Theoretical Physics, *Spring 2015*
4. Summer School in Theoretical Physics, Utrecht University (Utrecht, NL), *Summer 2009*
5. Department of Energy Science Undergraduate Laboratory Internships, Stanford University (Stanford, CA), *Summer 2008*