

ALEKSANDER ZUJEV

Curriculum Vitae

Department of Physics
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EDUCATION

1974-1976: Moscow State University, mechanical-mathematical department.

1980-1985: Dnepropetrovsk State University, diploma supervisor Professor N. V. Polyakov. Master of Science (Equivalent) in Mathematics, with distinction (*Cum Laude*).

2002-2003: Preparing for graduate school: Attending by “open campus” PHY 215 classes Quantum Mechanics, Professor W. E. Pickett. Prepared for and completed GRE tests.

2003-2010: Graduate School, Physics Department, UC Davis. Condensed matter, supervisor Professor R. T. Scalettar. Ph.D. in Physics.

AWARDS

High School Awards

1971: Winner of Republican (Ukraine) Physics Olympiad, I degree

1971: Winner of All-Union (USSR) Physics Olympiad, I degree

1972: Winner of Republican (Ukraine) Physics Olympiad, III degree

1972: Winner of All-Union (USSR) Physics Olympiad, III degree

1972: Winner of Voroshilovgrad Oblast Mathematics Olympiad, II degree

Work Awards

1982: Best Young Specialist, Project Institute Dneprogiproshaht, Dnepropetrovsk, Ukraine

EMPLOYMENT

1976-1988: Dnepropetrovsk, Ukraine, Project Institute “Dneprogiproshaht”. Computer operator, then programmer.

- Participated in “Plan” project -Programming for optimization of work scheduled, along with recording and tallying hours worked.

- Participated in “Deformations” project - calculating and modeling how mines influence earth surface, cause stresses, and other types of terrestrial dynamics. Performed some clever interpolation similar to my diploma project.

- Created a system of macros to achieve structural programming in Assembly language.

1988-1994: Tallinn, Estonia, Volta Fabrique. Programmer.

- Routine programming of variety of requests.

- Freelance job: Created a program I called “Smart Needle” to embroider ornaments on clothing. My program generated code for embroidery machines. The user entered a digital picture of the future embroidery from which the program generated the code. Process was visible, so that the user may preview and correct.

- Exercise: Wrote my own version of LISP language.

1994-1998: Tallinn, Estonia, EVEA bank. Programmer in Eveacom project - a system for remote banking for dial-up clients.

EMPLOYMENT (continued)

1998-1999: Co-Owner of internet promotional company - Program posted advertisements on “Free For All” pages on the Internet. Written originally in Unix, I later made a variant for Windows.

1999-2001: Freelance programming. An example: Creating a website to help a client sell her home-made soap online.

2003 - 2010: Teaching Assistant and Research Assistant, UC Davis.

2010 - 2013: Research Fellow, NTU, Singapore. Group of Dr. Pinaki Sengupta.

2013 - present: Visiting Scholar, UC Davis. Group of Dr. Richard Scalettar.

PUBLICATIONS

- About one numerical scheme of solution of boundary problems for biharmonic equations, N. V. Polyakov, A. S. Zujev, Depository of VINITI (1985, admitted 1986) (in Russian)
- Monte Carlo simulations of the superfluid phase transition in an extended Feynman-Kikuchi model, A. Zujev and R. T. Scalettar, Phys. Rev. B 76, 174524 (2007)
- Superfluid and Mott-insulator phases of one-dimensional Bose-Fermi mixtures, A. Zujev, A. Baldwin, R. T. Scalettar, V. G. Rousseau, P. J. Denteneer, and M. Rigol, Phys. Rev. A 78, 033619 (2008)
- Isentropic curves at magnetic phase transitions, J. D. Cone, A. Zujev, and R. T. Scalettar, Phys. Rev. B 83, 045108 (2011)
- Induced magnetism vs. Kondo screening in alternating Mott-metal layers, Aleksander Zujev and Pinaki Sengupta, Phys. Rev. B 88, 094415 (2013)
- Pairing Correlations in the two-layer attractive Hubbard Model, Aleksander Zujev, Richard T. Scalettar, George G. Batrouni, Pinaki Sengupta, New Journal of Physics 16 (2014) 013004
- A diophantine sum with factorials, Geoffrey B. Campbell and Aleksander Zujev, arXiv preprint arXiv:1510.03056 (2015)
- Variations on Ramanujan’s nested radicals, Geoffrey B. Campbell and Aleksander Zujev, arXiv preprint arXiv:1511.06865 (2015)
- Gaussian integer solutions for the fifth power taxicab number problem, Geoffrey B. Campbell and Aleksander Zujev, arXiv preprint arXiv:1511.07424 (2015)

CONFERENCES / WORKSHOPS

Oct 2005: California Section APS Meeting. Talk: Superfluidity and Feynman-Kikuchi Model in 2-D

Feb 2009: DARPA “Optical Lattice Emulator” Collaboration Meeting, UC Berkeley.

Mar 2009: APS Meeting, Pittsburgh. Talk: t-J Model: DQMC with Infinite U Approach

Jun 2009: Electronic Structure ES09 Workshop, UC Davis.

Mar 2010: APS Meeting, Portland. Talk: Mean Field Theory Calculation of Isentropic Curves of the Fermion Hubbard Model

Mar 2012: APS Meeting, Boston. Talk: Pairing Correlations in the two-layer attractive Hubbard Model

JOURNAL CLUB PRESENTATIONS AND GROUP TALKS

- Jan 2005:** What is Quantum Monte Carlo?
- Dec 2005:** Lanczos algorithm: Hard-core bosons in 1-D
- Feb 2006:** Thermodynamics of an incommensurate quantum crystal
- May 2006:** Finite size scaling: How-to Introduction using Ising model
- Feb 2007:** Introduction to Spin Hall Effect
- May 2007:** Quantum Computing with Optical Lattices
- Dec 2007:** Introduction to Luttinger Liquid
- Feb 2008:** De Haas-van Alphen Effect
- Aug 2008:** Infinite U Hubbard Model
- Nov 2008:** Fractional Quantum Hall Effect and Quantum Computer
- Mar 2009:** Hole Superconductivity Theory (Controversial theory by J. E. Hirsch)
- May 2009:** Quantum Teleportation
- Nov 2009:** Quantum Cryptography
- Jun 2014:** Independent and Coupled Systems

FINAL PROJECTS

- Fall 2004:** Introduction to General Relativity: Closed Timelike Curves
- Winter 2005:** Condensed Matter Physics B: Superfluidity and Feynman-Kikuchi Model
- Winter 2007:** Advanced Electronic Structure: Constructing Pseudopotentials
- Spring 2009:** Large Scale Scientific Computing: CS (cosine-sine) Decomposition

RESEARCH EXPERIENCE

During the last academic year I concluded that, for my research, the combination of Physics, Mathematics, and Computer Science works very well - "Synergy" - and should be applied systematically. Accordingly, I am reviewing and studying relevant fields of Mathematics and Computer Science.

Programming, or computer science, is central in my work. Much of the programming I do myself.

Main objects of research: Optical lattices, Superconductivity, Superfluidity, Bose-Einstein condensate, Supersolid.

Main methods: Quantum Monte Carlo.

My experience includes:

- Classical Monte Carlo;
- Determinant Quantum Monte Carlo;
- Exact Diagonalization;

- Lanczos method.
- Stochastic Series Expansion;
- Path Integral Monte Carlo;
- Worm Algorithm.

Current Work

- 2-D Hardcore Bosons System (with Richard Scalettar and Pinaki Sengupta).
- 2-D Disordered Hubbard Model (with Richard Scalettar).
- Independent and Coupled Systems (with John Mahoney and James Crutchfield).
- Non-Unitary Quantum Computing.

Computing Experience

- Operating Systems: Unix, Windows.
- Programming languages: C, Fortran, Pascal, Assembler, LISP, Perl, Python.
- 4th generation programming languages: Mathematica, MATLAB.
- Experience in Message Passing Interface.

Other Interests in Physics

- I am particularly interested in Quantum Computation. I have studied this field and have presented on it in the Journal Club.
- Interest: Taking or auditing classes in Physics, Mathematics, Computing Science. Recently was taking/auditing classes in Chaos and Nonlinear Dynamics:
 - James Crutchfield's class "Natural Computation and Self-Organization";
 - Chew Lock Yue's class "Nonlinear Dynamics";
 - Raissa D'Souza's class "Network Theory and Applications";
 - Mark Goldman's seminar "Topics in Neuroscience";
 - Umesh Vazirani's online course "Quantum Mechanics and Quantum Computation".

TEACHING EXPERIENCE

1984: Dnepropetrovsk University. Teaching practice in adult high school.

2003-2009: UC Davis, Teaching Assistant. Grading variety of upper division undergraduate and graduate classes in physics.

2005-2010: Davis, Baciardini's Martial Arts School, Instructor. Taught Kempo Karate to a variety of adult students using modern teaching styles.

2000: Tallinn, Estonia. Experimenting with programmed education. Studied work of B. F. Skinner. Wrote a program for helping to study foreign language - vocabulary building program. Used myself at studying German.

SPORT

- Karate - **1985:** Dnepropetrovsk, Ukraine, class by brothers Matyushin (5th Dans of Kyoshinkai Karate).
- 2005 - 2010:** Davis, class by Richard Baciardini (5th degree Black Belt in Kempo Karate).

Earned 1st and 2nd degree black belts in Kempo Karate.

- Taekwondo - **2010 - 2013**: Singapore, class by Keith Chua "Shifu" (4th Dan).
As of July 2012, 1st Dan.
2013 - present: UC Davis, Experimental College.
- Biking - Regularly exercise - 20-30 miles (30-50 km) daily.

LANGUAGES

- English
- Russian (native speaker)
- German - some reading and speaking
- Polish - reading
- Estonian - some reading and speaking
- Currently trying to study Mandarin Chinese

ACADEMIC REFEREES

Richard Scalettar
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