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EDUCATION

Ph.D., Physics, University of Southern California, December 1997

Dissertation title: Fluctuation Exchange Theory for General Lattice Hamiltonians

Dissertation adviser: Professor Nelson Eugene Bickers

M.A., Physics, University of Southern California, May 1995

B.S., Physics, Boğaziçi University, Istanbul, Turkey, July 1992

B.S., Electrical and Electronics Engineering, Boğaziçi University, Istanbul, Turkey,
July 1992

TEACHING EXPERIENCE

Instructional-laboratory director, Department of Physics and Astronomy, University of Southern California, October 2002–present.

Developing, organizing, and managing the undergraduate teaching laboratories.

Laboratory instructor, Department of Physics, University of California, Davis, April 2002–June 2002. Supervisor: Dr. Randy Harris.

Taught and helped improve computerized classical-mechanics labs.

Graduate teaching assistant, Department of Physics and Astronomy, University of Southern California, September 1992–May 1995. Supervisor: Professor Richard S. Thompson.

Teaching duties included electromagnetism laboratories for engineering students and discussion sessions for nonscience, biological-science, and engineering students.

RESEARCH AREAS OF SPECIALIZATION

- Theoretical and computational condensed-matter physics
- Strongly correlated electrons
- Self-consistent field theories

- Fluctuation-exchange approximation (FLEX)
- Numerical renormalization-group methods (NRG)
- High-temperature superconductivity
- f -electron systems
- Dynamical mean-field theory (DMFT)

RESEARCH EXPERIENCE

Instructional-laboratory director, Department of Physics and Astronomy, University of Southern California, October 2002–present.

Discovered the importance of the orbital ordering in the volume-collapse phenomenon.

Postdoctoral research associate, Department of Physics, University of California, Davis, and Materials Research Institute, Lawrence Livermore National Laboratory, University of California, September 1999–September 2002. Advisers: Professor Richard T. Scalettar (University of California, Davis) and Dr. Andrew K. McMahan (Lawrence Livermore National Laboratory).

Successfully developed realistic methods for strongly correlated electron systems aimed at bridging the quantum chemistry with quantum many-body techniques. Implemented the “local-density approximation + fluctuation-exchange approximation” for metallic cerium and now integrating the dynamical mean-field theory into this method. Performed extensive analysis of the basic periodic Anderson model in a combined quantum Monte Carlo, fluctuation-exchange approximation, and mean-field theory study.

Postdoctoral research associate, Center for Simulational Physics, Department of Physics and Astronomy, University of Georgia, October 1997–September 1999. Adviser: Professor Heinz-Bernd Schüttler.

For the very first time in the field, analyzed the d -wave superconductivity under the long-range Coulomb interaction with microscopic many-body methods. Developed a new diagrammatic approximation with screened interaction lines as well.

Graduate research assistant, Department of Physics and Astronomy, University of Southern California, September 1994–September 1997. Adviser: Professor Nelson Eugene Bickers.

As a graduate student, developed a systematic method for efficiently implementing the fluctuation-exchange approximation for realistic models including many orbital degrees of freedom and general Coulomb-interaction terms. Carried out the only *ab initio* T_c calculation for $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ to date and successfully reproduced the quantitative phase diagram in the overdoped region. Proposed and calculated an exotic order parameter in the underdoped region for the very first time (the incommensurate orbital antiferromagnet).

Graduate research assistant, Department of Physics and Astronomy, University of Southern California, January 1994–September 1994. Adviser: Professor Gerd Bergmann.
Carried out calculations on the Anderson impurity model. Involved in low-temperature experiments.

PUBLICATIONS

- [1] “Fluctuation-exchange theory for general lattice Hamiltonians,” Gökhan Esirgen and N. E. Bickers, *Phys. Rev. B* **55**, 2122 (1997).
- [2] “Fluctuation exchange analysis of superconductivity in the standard three-band CuO_2 model,” Gökhan Esirgen and N. E. Bickers, *Phys. Rev. B* **57**, 5376 (1998) [cond-mat/9711151].
- [3] “ d -wave pairing in the presence of long-range Coulomb interactions,” Gökhan Esirgen, H.-B. Schüttler, and N. E. Bickers, *Phys. Rev. Lett.* **82**, 1217 (1999) [cond-mat/9806264].
- [4] “Screened-interaction expansion for the Hubbard model and determination of the quantum Monte Carlo Fermi surface,” Gökhan Esirgen, Heinz-Bernd Schüttler, Carsten Gröber, and Hans Gerd Evertz, *Phys. Rev. B* **64**, 195105 (2001) [cond-mat/0105514].
- [5] “Doping-dependent study of the periodic Anderson model in three dimensions,” Thereza Paiva, Gökhan Esirgen, Richard T. Scalettar, Carey Huscroft, and A. K. McMahan, *Phys. Rev. B* **68**, 195111 (2003) [cond-mat/0109497].

MEETINGS ATTENDED AND TALKS GIVEN

- [1] “Self-consistent field theory for the three-band CuO_2 model,” G. Esirgen and N. E. Bickers, March Meeting of the American Physical Society, St. Louis, Missouri, March 1996.
- [2] “Basis set studies for SCF calculation of two-particle correlation functions and eigenvalues,” N. E. Bickers and G. Esirgen, March Meeting of the American Physical Society, St. Louis, Missouri, March 1996.
- [3] “Fluctuation exchange theory for general lattice Hamiltonians,” High-Temperature-Superconductivity Seminar, Department of Physics, University of California, Santa Barbara, California, November 1996.
- [4] “Ordering instabilities in the three-band CuO_2 model,” G. Esirgen and N. E. Bickers, March Meeting of the American Physical Society, Kansas City, Missouri, March 1997.
- [5] “Fluctuation exchange theory for general lattice Hamiltonians (3-band CuO_2 model as an example),” Solid-State-Physics Seminar, Department of Physics and Astronomy, University of Southern California, Los Angeles, California, April 1997.
- [6] “Self-consistent field approaches to quantum many body problems in solid state physics,”

Theoretical-Physics Seminar, Department of Physics and Astronomy, University of Georgia, Athens, Georgia, November 1997.

- [7] “Understanding interacting electron systems,” Center for Simulational Physics Seminar, Department of Physics and Astronomy, University of Georgia, Athens, Georgia, December 1997.
- [8] “Fluctuation exchange analysis of superconductivity in the standard three-band CuO₂ model,” G. Esirgen and N. E. Bickers, March Meeting of the American Physical Society, Los Angeles, California, March 1998.
- [9] “Beyond the Hubbard model: the effect of extended Coulomb interactions,” H.-B. Schüttler, G. Esirgen, and N. E. Bickers, March Meeting of the American Physical Society, Los Angeles, California, March 1998.
- [10] “Beyond the Hubbard model: the effect of extended Coulomb interactions,” Center for Simulational Physics Seminar, Department of Physics and Astronomy, University of Georgia, Athens, Georgia, April 1998.
- [11] “Perturbative expansions in terms of screened interactions for the two-dimensional Hubbard model,” Center for Simulational Physics Seminar, Department of Physics and Astronomy, University of Georgia, Athens, Georgia, February 1999.
- [12] “Progress in modern diagrammatic approaches to strongly correlated electrons,” Twelfth Annual Workshop for Recent Developments in Computer Simulation Studies in Condensed Matter Physics, Physics Building, University of Georgia, Athens, Georgia, March 1999.
- [13] “Divergent vertex and polarization insertion in large- U Hubbard models,” G. Esirgen and H.-B. Schüttler, March Meeting of the American Physical Society, Atlanta, Georgia, March 1999.
- [14] “From QED to QCD and BCS to hi- T_c : still an unwon battle,” Condensed-Matter Seminar, Department of Physics, University of California, Davis, California, January 2000.
- [15] “Fluctuation-exchange analysis of the three-dimensional periodic Anderson models,” G. Esirgen, R. T. Scalettar, and A. K. McMahan, March Meeting of the American Physical Society, Minneapolis, Minnesota, March 2000.
- [16] “All-orbital LDA+FLEX theory of Ce,” G. Esirgen, A. K. McMahan, and R. T. Scalettar, March Meeting of the American Physical Society, Seattle, Washington, March 2001.
- [17] “Volume-collapse transition in f -electron systems,” Condensed-Matter Seminar, Department of Physics and Astronomy, University of Southern California, Los Angeles, California, March 2001.
- [18] “LDA+DMFT-FLEX studies of cerium and other $4f$ -electron metals,” G. Esirgen, A. K.

McMahan, and R. T. Scalettar, March Meeting of the American Physical Society, Indianapolis, Indiana, March 2002.

- [19] “Orbital ordering and volume collapse in cerium,” G. Esirgen, A. K. McMahan, and R. T. Scalettar, March Meeting of the American Physical Society, Los Angeles, California, March 2005.

HONORS

- High-honor graduate (on the campuswide list of topmost ten), Boğaziçi University, Istanbul, Turkey, July 1992

PROFESSIONAL AFFILIATIONS

- Member, American Physical Society, 1992–present

REFERENCES

- Professor Nelson Eugene Bickers, Department of Physics and Astronomy, University of Southern California, Los Angeles, CA 90089-0484; phone: (213) 740-1114, fax: (213) 740-6653, E-mail: bickers@usc.edu
- Professor Heinz-Bernd Schüttler, Department of Physics and Astronomy, University of Georgia, Athens, GA 30602-2451; phone: (706) 542-2485, fax: (706) 542-2492, E-mail: hbs@physast.uga.edu
- Professor Richard T. Scalettar, Department of Physics, University of California, Davis, CA 95616-8677; phone: (530) 754-9105, fax: (530) 752-4717, E-mail: rts@watson.ucdavis.edu
- Dr. Andrew K. McMahan, L-045, Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, CA 94551-0808; phone: (925) 422-7198, fax: (925) 422-2851, E-mail: mcma-han1@llnl.gov
- Dr. Randy Harris, Department of Physics, University of California, Davis, CA 95616-8677; phone: (530) 752-8897, fax: (530) 752-4717, E-mail: harris@physics.ucdavis.edu
- Professor Tu-nan Chang, Chair, Department of Physics and Astronomy, University of Southern California, Los Angeles, CA 90089-0484; phone: (213) 740-1133, fax: (213) 740-1506, E-mail: tnchang@usc.edu