

Nuh GEDIK

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EDUCATION

- Ph.D. Physics (GPA 4.0/4.0), *University of California, Berkeley* (05/04)
- M.A. Physics (GPA 4.0/4.0), *University of California, Berkeley* (05/01)
- B.S. Physics (1st Honors), *Bogazici University, Istanbul, Turkey* (08/98)

APPOINTMENTS

- Assistant Professor, Physics Department, *MIT* (01/08 – present)
- Postdoctoral Scholar, Prof. Ahmed Zewail group, Chemistry Department, *Caltech* (07/04 – 01/08)
- Graduate Student Researcher, Prof. Joe Orenstein group, Physics Department, *UC Berkeley* (06/99 – 05/04)

HONORS AND AWARDS

- NSF CAREER Award (07/09)
- NEC Corporate Fund Award, MIT Research Support Committee (06/08)
- Michael and Philip Platzman Fund for Junior Faculty in Physics, MIT (01/08)
- Berkeley Physics Department Fellowship (08/98 – 08/00)
- The Scientific and Technical Research Council of Turkey Fellowship (08/95 – 08/98)
- Bogazici University Physics Department Fellowship (08/95 – 08/98)
- 7th Rank** Among Over 1 Million Candidates, The University Entrance Exam in Turkey (06/95)
- Bronze Medal**, 26th International Physics Olympiad Canberra, Australia (07/95)
- Silver Medal**, National Physics Olympiad of Turkey (12/94)

PUBLICATIONS

- "Unconventional superconductivity in single crystals of $Ba_{0.6}K_{0.4}Fe_2As_2$ revealed by pump-probe spectroscopy" Darius H Torchinsky, G.F. Chen, J.L. Luo, N. L. Wang, and Nuh Gedik (submitted 2009)
- "Non-equilibrium phase transitions in cuprates observed by ultrafast electron crystallography" N. Gedik, Ding-Shyue Yang, Gennady Logvenov, Ivan Bozovic, and Ahmed H. Zewail *Science* **316**, 425 (2007) ([pdf](#)).
- "Ultrafast Electron Crystallography: I. Non-equilibrium Dynamics of Nanometer-scale Structures" Ding-Shyue Yang, N. Gedik and Ahmed H. Zewail, *J. Phys. Chem. C* **111**, 4889 (2007) ([pdf](#)). ([cover story](#))
- "Observation of spin Coulomb drag in a two-dimensional electron gas" C. P. Weber, N. Gedik, J. E. Moore, J. Orenstein, J. Stephens, and D. D. Awschalom, *Nature* **437**, 1330-1333 (2005). ([pdf](#))
- "Abrupt transition in quasiparticle dynamics at optimal doping in a cuprate superconductor system" N. Gedik, M. Langner, J. Orenstein, S. Ono, Yasushi Obe, and Yoichi Ando, *Phys. Rev. Lett.* **95**, 117005 (2005). ([pdf](#))
- "Transient gratings formed by nonequilibrium quasiparticles in YBCO", N. Gedik, J. Orenstein, Ruixing Liang, D.A. Bonn, and W.N. Hardy, *Journal of Superconductivity* **17** –(1): 117-120, (2004). ([pdf](#))
- "Non-equilibrium quasiparticle dynamics in single crystals of YBCO Ortho II" N. Gedik, J. Orenstein, Ruixing Liang, D.A. Bonn, and W.N. Hardy, *Physica C* **408-410**, 690 (2004). ([pdf](#))
- "Absolute Phase Measurement in Heterodyne Detection of Transient Gratings" N. Gedik, J. Orenstein, *Optics Letters* **29**, 2109 (2004). ([pdf](#))
- "Single-quasiparticle stability and quasiparticle-pair decay in $YBa_2Cu_3O_{6.5}$ ", N. Gedik, P. Blake, R.C. Spitzer, J. Orenstein, D.A. Bonn, Ruixing Liang, and W.N. Hardy, *Phys. Rev. B* **70**, 014504 (2004). ([pdf](#))
- "Reply to Comments on 'Photoinduced changes of reflectivity in single crystals of $YBa_2Cu_3O_{6.5}$ (Ortho II)'" N. Gedik, J. Orenstein, D.A. Bonn, Ruixing Liang, W.N. Hardy, *Phys. Rev. Lett.* **91**, 169701 (2003). ([pdf](#))
- "Diffusion of nonequilibrium quasi-particles in a cuprate superconductor", N. Gedik, J. Orenstein, Ruixing Liang, D.A. Bonn, and W.N. Hardy, *Science* **300**, 1410 (2003). ([pdf](#))
- "Photoinduced changes of reflectivity in single crystals of $YBa_2Cu_3O_{6.5}$ " G.P. Segre, N. Gedik, J. Orenstein, D.A. Bonn, Ruixing Liang, W.N. Hardy, *Phys. Rev. Lett.* **88**, 137001 (2002). ([pdf](#))

News Coverage

- "Spin in the slow lane", *Nature* **437**, 1249 (2005). ([pdf](#)).
- "Watching Quasiparticles Move", *LBL MSD Research Highlights*, April 4th, 2003. ([html](#)).
- "Tracking the Strange Behavior of Quasiparticles", P. Preuss, *LBL Science Beat*, Sept.23rd, 2003 (<http://enews.lbl.gov>).
- "Broken Cooper Pairs Caught Bouncing Around", B. Keimer, *Science* **300**, 1381 (2003). ([pdf](#))

Ph.D. Thesis

"Recombination and Propagation of Quasiparticles in Cuprate Superconductors" N. Gedik, Ph.D. thesis in Physics, University of California at Berkeley (May 2004). ([pdf](#))

RESEARCH SUMMARY

Assistant Professor, Department of Physics, MIT (01/08 - present)

Ultrafast electronic and structural dynamics in complex materials: We are developing and using advanced optical techniques for investigating ultrafast processes in solids, nanostructures and interfacial molecular assemblies. Experimental techniques include ultrafast electron diffraction, pump-probe and transient grating spectroscopy and time domain terahertz spectroscopy. We are especially interested in using these techniques to understand fascinating properties of strongly correlated electron systems such as cuprate superconductors.

Postdoctoral Researcher, Prof. Ahmed Zewail Group, Caltech (07/04 - 01/08)

Structural dynamics in solids and at interfaces with atomic-scale resolution: Used ultrafast electron diffraction (UED) to investigate structural dynamics in solids, nanostructures and interfacial molecular assemblies. Specific systems studied include cuprate superconductors, GaAs quantum well structures and interfacial water assemblies at hydrophobic and hydrophilic surfaces. UED can provide ultra-short spatial resolution (0.1 to 1nm) combined with ultrafast time resolution (10^{-13} to 10^{-12} s) with sub-monolayer sensitivity.

Graduate Student Researcher, Prof. Joseph Orenstein Group, UC Berkeley (05/99 - 05/04)

Quasiparticle dynamics in high temperature superconductors: Developed a novel transient grating spectroscopy setup and measured diffusion coefficient of nonequilibrium quasiparticles in high temperature superconductors for the first time, obtained elastic and inelastic quasiparticle scattering rates using ultrafast optical spectroscopy.

Optical manipulation of spins in quantum wells: Used transient spin grating spectroscopy to measure spin diffusion in quantum wells and for the first time observed spin Coulomb drag (SCD) by showing that spin diffusion is smaller than charge diffusion as a result of electron-electron interactions in excellent quantitative agreement with SCD theory.

TEACHING EXPERIENCE

Recitation instructor for Vibration and Waves (Physics 8.03), Department of Physics, MIT (Spring 08)

Graduate student instructor, Physics Department, UC Berkeley (08/99 – 05/00)

Teaching assistant, Physics Department, University of Southern California (08/98– 05/99)

PROFESSIONAL ACTIVITIES

- Program committee member for two SPIE conferences: "Nanosensing: materials and devices II" and "Nanostructure integration techniques for manufacturable devices, circuits and systems: interfaces, interconnects, and nanosystems" (23–26 October 2005)
- Member of American Physical Society (APS)
- Referee for Science, Physical Review Letters and Chemical Physics Letters
- Invited panel member for "Ultrafast Materials Science" workshop. This study was sponsored by Council for the Division of Materials Sciences and Engineering, Office of Basic Energy Sciences of U.S. Department of Energy. The goal was to develop a comprehensive and strategic framework for research in Ultrafast Materials Science which will identify research opportunities to advance scientific progress in this rapidly-developing field. (21 -24 October 2007, Santa Fe, NM)
- International Advisory Committee Member for International Conference on Superconductivity and Magnetism 25-30 April 2010 Antalya, Turkey

INVITED TALKS

Conferences

1. "Ultrafast electronic and structural dynamics in superconductors" **Femtochemistry IX, The 9th international conference on fundamental ultrafast processes in chemistry, biology, and physics**, Peking University, Beijing, China August 8-13, 2009.
2. "Photoinduced structural phase transition in a cuprate superconductor observed by ultrafast electron diffraction" **3rd International Conference on Photo-Induced Phase Transitions and Cooperative Phenomena (PIPT2008)**, Osaka, Japan, November 11-15, 2008.
3. "Ultrafast structural dynamics observed with atomic scale resolution", **Workshop on Dynamics of Materials in Extreme Fields in 2008 NSLS/CFN Users' Meeting**, Upton, NY (May 19, 2008)
4. "Photoinduced structural phase transition in a cuprate superconductor observed by ultrafast electron diffraction" **Gordon Conference on Ultrafast Phenomena in Cooperative System**, Lucca (Barga), Italy (February 3-8th, 2008)
5. "Time-resolved measurements of quasiparticle recombination and propagation in cuprate superconductors", **8th International Conference on Materials and Mechanisms of Superconductivity and High Temperature Superconductors**, Dresden, Germany (July 9-14th, 2006).
6. "Ultrafast measurements of quasiparticle dynamics in cuprates and spin diffusion in quantum wells", **Ultrafast dynamics of collective excitations in solids: 355. Wilhelm und Else Heraeus-Seminar**, Vitte, Hiddensee islands, Germany (September 11-15th, 2005).
7. "Quasiparticles dynamics in cuprates: recombination and propagation", **Aspen Winter Conference 2005 in Condensed Matter Physics: High-Temperature Superconductivity**, Aspen, Co (January 14th, 2005).
8. "Recombination and diffusion of nonequilibrium quasiparticles in high-Tc cuprates", Division of Condensed Matter Physics symposium on Excitations in Strongly Correlated Materials II, **APS March Meeting 2004**, Montreal, Canada (March 26th, 2004).
9. "Recombination and propagation of nonequilibrium quasiparticles in high-Tc superconductors", **Dynamic inhomogeneities in complex oxides**, 14. - 20. June 2003, Bled, Slovenia.
10. "Recombination and propagation of nonequilibrium quasiparticles in high-Tc superconductors", **CIAR Quantum Materials Summer School**, May 14th 2003 in Vancouver, Canada.

University Seminars

1. "Ultrafast Structural Dynamics Observed with Atomic Scale Resolution", Condensed Matter Physics Seminar, **UC Berkeley** (October 12th, 2009)
2. "Ultrafast Electronic and Structural Dynamics in High Temperature Superconductors", Condensed Matter Physics Seminar, **Princeton University** (October 5th, 2009)
3. "Seeing the ultra-small and capturing the ultra-fast" Physics IAP Lecture Series, **MIT** (Jan 20th, 2009).
4. "Ultrafast Structural Dynamics Observed with Atomic Scale Resolution", Condensed Matter Physics Seminar, **Florida State University, Magnet Lab** (October 10th, 2008).
5. "Ultrafast Structural Dynamics Observed with Atomic Scale Resolution", Physical Chemistry Seminar, **MIT Chemistry Department** (September 23rd, 2008)
6. "Ultrafast structural dynamics observed with atomic scale resolution", Materials Science and nanotechnology Graduate Program Seminar, Institute of Materials Science & Nanotechnology, **Bilkent University**, Ankara, Turkey (January 10th, 2008)
7. "Ultrafast structural dynamics observed with atomic scale resolution", Math-Science Seminar, **Koc University**, Istanbul, Turkey (January 8th, 2008)
8. "Ultrafast structural dynamics observed with atomic scale resolution" Condensed-Matter Physics Seminar, Physics Department, **Caltech**, (November 30th, 2007)
9. "Ultrafast structural dynamics observed with atomic scale resolution" CUOS Seminar, Electrical Engineering and Computer Science, **University of Michigan**, (March 22nd, 2007)
10. "Ultrafast structural dynamics observed with atomic scale resolution" Condensed-Matter Physics Seminar, Physics Department, **Rutgers University**, (March 20th, 2007)

University Seminars Cont.

11. "Ultrafast structural dynamics observed with atomic scale resolution" LASSP Seminar, Physics Department, **Cornell University**, (February 28th, 2007)
12. "Ultrafast structural dynamics observed with atomic scale resolution" Condensed-Matter Physics Seminar, Physics Department, **MIT**, (February 20th, 2007)
13. "Ultrafast structural dynamics observed with atomic scale resolution" Condensed-Matter Physics Seminar, Physics Department, **University of Maryland**, (February 12th, 2007)
14. "Ultrafast structural dynamics observed with atomic scale resolution" Condensed-Matter Seminar, Physics Department, **University of Minnesota**, (February 8th, 2007)
15. "Ultrafast structural dynamics observed with atomic scale resolution" Condensed-Matter Physics Seminar, Physics Department, **University of Toronto, Canada**, (February 5th, 2007)
16. "Ultrafast structural dynamics observed with atomic scale resolution" Condensed-Matter Physics & Materials Science Seminar, **Brookhaven National Lab**, (January 19th, 2007)
17. "Capturing the ultrafast motions of charge, spin and lattice in complex materials" Physics Department, **Whittier College** (October 27th, 2006)
18. "Time resolved measurements of charge, spin and lattice dynamics", Condensed-Matter Physics & Materials Science Seminar, **Brookhaven National Lab**, (July 6th, 2006).
19. "Ultrafast dynamics of quasiparticles in cuprates and spins in quantum wells", Condensed Matter Seminar, Dept. of Physics and Astronomy, **UCLA**, (November 9th, 2005).
20. "Tracking the electrons in high temperature superconductors", Dept of Physics and Astronomy, **California State University, Northridge** (February 9th, 2005).
21. "Tracking the quasiparticles in high temperature superconductors", Dept. of Physics, **Bilkent University**, Ankara, Turkey (June 10th, 2004).
22. "Dynamics of quasiparticles in high temperature superconductors", Dept. of Physics, **Middle East Technical University**, Ankara, Turkey (June 9th, 2004).
23. "Quasiparticle dynamics in high temperature superconductors", Dept. of Physics, **Koc University**, Istanbul, Turkey (June 3rd, 2004).
24. "Tracking the quasiparticles in high temperature superconductors", Faculty of Engineering and Natural Sciences, **Sabanci University**, Istanbul, Turkey (June 2nd, 2004).
25. "Quasiparticle dynamics in high temperature superconductors", Dept. of Physics, **Bogazici University**, Istanbul, Turkey (June 1st, 2004).
26. "Tracking the elusive d-wave quasiparticle", Chez Pierre Seminar, Dept. of Physics, **MIT**, (April 12th, 2004).
27. "Tracking the Quasiparticles in High Temperature Superconductors", Dept. of Physics, **Columbia Univ.**, (March 30th, 2004).
28. "Tracking the Quasiparticles in High Temperature Superconductors", **Rowland Institute at Harvard** (March 29th, 2004).
29. "Tracking the Quasiparticles in High Temperature Superconductors", JILA Seminar, **JILA**, Boulder, Co. (March 15th, 2004).
30. "Tracking the elusive d-wave quasiparticle", Condensed Matter Seminar, Physics Department, **Rice University**, (November 24th, 2003).
31. "Tracking the elusive d-wave quasiparticle", Condensed Matter Seminar, Physics Department, **University of Texas at Austin**, (November 11th, 2003).
32. "Tracking the elusive d-wave quasiparticle", Herb Seminar, Physics Department, **University of Wisconsin at Madison**, (October 30th, 2003).

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SYNERGISTIC ACTIVITIES

Research mentor for Caltech's Freshman Summer Institute (FSI) program

The FSI program is designed to enhance the transition from high school to a research-based institution such as Caltech. It is organized by the Office for Minority Student Education and aimed especially towards minority students. During the summer of 2005, I was selected as one of the research mentors for this program and supervised an incoming freshman student in the lab

Founder and board member, Berkeley Multicultural Activity Club (BMAC), (2000-2003)

Founded BMAC for bringing students from different cultures together, served as a board member, actively involved in organizing activities and social events.