Curriculum vitae for Milind Kunchur

Contact information: Department of Physics and Astronomy, 712 Main St. PSC 404, University of South Carolina, Columbia, SC 29208. Email: kunchur@mailbox.sc.edu. Phone: 803 777 1907.

Education: Ph.D. in Physics, Rutgers University, 1988.

Professional recognition and experience:
- Governor's Distinguished Professor (2014).
- Michael J. Mungo Distinguished Professor (2012).
- Professor of Physics and Astronomy, University of South Carolina (Aug. 2005—present).
- Associate Professor of Physics and Astronomy, University of South Carolina (Aug. 2000—July 2005).
- Assistant Professor of Physics and Astronomy, University of South Carolina (Jan. 1997—July 2000).
- NRC Senior Fellow at Wright Patterson Air Force Base (June 1995—Dec. 1996).
- ORISE Research Associate at Oak Ridge National Laboratory (Nov. 1991—June 1995).
- Postdoctoral Research Associate at University of Virginia (July 1988—Sept. 1991).

Teaching/general honors and highlights:
- Post-tenure reviews: "Superior" ratings in all 3 categories of Research, Teaching, and Service (for both 2011 and 2017).
- Carnegie Foundation & CASE U.S. Professors of the Year Award (2014 SC winner) USProfessorsOfTheYear
- Governor's Professor of the Year for the State of South Carolina (2014). State's highest honor for academia
- George B. Pegram Medal from SESAPS for 'Excellence in Physics Education in the Southeast U.S.' (2014).
- Michael J. Mungo Distinguished Professor of the Year at the Univ. of South Carolina (2012).
- SC Honors College's Michael A. Hill Outstanding Faculty Member award (2017).
- Michael J. Mungo Teaching Award at the University of South Carolina (2001).
- Highest ratings in all Peer-Review-of-Teaching evaluations (1999, 2000, 2004, 2009, 2013, 2017). All PRT reports
- Courses taught: Phys 155,155L,201,202,206,207,211,212,309,441,512,730,750A,760,761,799,899. Descriptions
- Most recent student evaluation scores: Spring 2018=5.0/5.0, Fall 2017=5.0/5.0, Spring 2017=5.0/5.0, Fall 2017=4.8/5.0
- Courses developed: Phys 155 'Musical Acoustics Lecture'. Phys 155 'Acoustics Laboratory'. Phys 441 'Undergraduate Seminar Training'. Phys 730 'Graduate Seminar Training'. Studio Setting for Phys 309 'Physics-major lab'.

Research honors and highlights:
- Fellow of the American Physical Society (APS) since 2012.
- Donald S. Russell Award for Research in Science, Mathematics, and Engineering (2014).
- Oak Ridge Associated Universities (ORAU) Ralph E. Powe Junior Faculty Enhancement Award (1998).
- Martin-Marietta Publication and Technical Achievement Award (1995).
- National Research Council Senior Fellowship (1995).
- 142 invited talks (including 4 invited talks at American Physical Society March Meetings with ~10,000 attendees).
- 41 first-author & 51 corresponding-author refereed publications, 142 total publs., 5 book chapters, and 5 review articles.
- Work cited in college-level textbooks in Superconductivity and Music Psychology, and in over 65 research-level books and review articles. Work highlighted 10 times in Nota Bene column of 'High-Tc Update' superconductivity newsletter.
- Three prizes in inter-collegiate undergraduate physics competitions.

Grant funding: U. S. Department of Energy (Basic Energy Sciences), *Dissipative and fast-timescale phenomena in superconductors*, Principal (single) investigator: M. N. Kunchur, $1,796,181 through 7/15/2019.

Research assistants and thesis mentees in the past 6 years:
- Graduate students: Charles Dean, Nahid Moghaddam, Stacy Varner, Dheyaa Alameri, Manlai Liang
- Undergraduate SCHC students: Andrew Lyons, Collin Johnson, Elizabeth Minten, Habiba Fayyaz, Keiko Bridwell, Janki Patel, Akhila Padi, Justin Putnam, Nathan Moisson, Christine Reid, Leslie Thelan, Joshua Wright, Kailey Sinclair

Professional and community service:
- Secretary and member-at-large of SACS-AAPT (South Atlantic Coast Sect. of the American Assoc of Physics Teachers).
- Selection committee for the SESAPS "George B. Pegram" medal for Excellence in Physics Education in the Southeast.
- Head Judge and Category Judge for the Annual Central South Carolina Science and Engineering Fair (2000—present).
- "Friend of American Physical Society" membership liaison 2006—present.
- Advisory Board Member of 'Physica C' journal 2012—present.
- Invited panelist for National Science Foundation (NSF) proposal-review meetings in 2000, 2005, and 2014.
- Invited member of Strategic Research Panel for the U.S. Department of Energy Superconductivity Peer Review (2005).
- Invited member of High Resolution Audio Panel for the Audio Engineering Society, London, U.K. (2010).

- Symposium-organizer/session-chair/judge at APS, MRS, EPS, SESAPS plus various topical conferences. Society abbr.
- Invited panelist for Department of Atomic Energy's "Young Achiever's Award" (2016).
- External reviewer for Tenure and Promotion cases at other Universities.
- Regular referee for proposals from funding agencies (DOE, NSF, ORAU, Research Foundation, etc.) and manuscripts from journals (Phys. Rev. Lett., Phys. Rev. B, Physica C, Appl. Phys. Lett., etc.).

University and college-level service: Tenure Review Board (chair), Russell and Educational Foundation Research Award Committee (chair), University Committee on Tenure and Promotion (panel chair), Mungo Distinguished Professor of the Year Award Selection Committee, External Member of Unit Tenure and Promotion Committee for Electrical Engineering Department, College Machine Shop Committee, Electron Microscopy Center Advisory Committee, Nanoscience Initiative Committee, Spring Showcase on the Horseshoe Representative, Faculty Senator, Ph.D. Thesis Committees of other Departments and Colleges.

Department-level service: Post Tenure Review Committee (chair), Peer Review of Teaching Committee (chair), Colloquium Committee (chair), Condensed Matter Physics Faculty Search Committee (chair), Undergraduate Curriculum Committee, Teaching and Research Mentor for Junior Faculty, Society of Physics Students (SPS) faculty advisor and outreach coordinator, Nanoscience Faculty Search Committee, , Space Committee, Awards Nomination Committee, Physics-High-School-Outreach Program, Midway Physics-Day Mentor at SC State Fair, SC Junior Science and Humanities Symposium, Recruiting at Graduate School Fairs at Conferences, Planning Committee.

Professional society memberships: American Physical Society (APS): Fellow, life. Southeastern Section of the APS (SESAPS): life. Division of Condensed Matter Physics (DCMP): life. South Atlantic Coast Section of the American Association of Physics Teachers (SACS-AAPT): life, officer (served as secretary and member-at-large).

LISTS OF PRESENTATIONS AND PUBLICATIONS

Keynote speeches and public talks

1. Keynote speaker for Honors College Convocation for Class of 2021, USC Koger Center, August 22, 2017.
2. Keynote commencement speaker at the Doctoral Hooding Ceremony, USC Koger Center, May 10, 2014.
3. Keynote speaker for Incoming Student Convocation for Class of 2016, USC Coliseum, August 2012.
4. USC Center for Teaching Excellence (CTE), "Engaging Non-Majors", February 27, 2013.
5. The Last Lecture Series, University of South Carolina, "Bridging Subjectivism with Science", November 13, 2013.
6. Science Café organization, Capital City Club, "High-Fidelity Sound Reproduction", March 9, 2010.

Invited talks at conferences

1. *High-end audio and the intricacies of the electronic reproduction of music,* M. N. Kunchur, Fall Meeting of the SACS-AAPT (South Atlantic Coast Sect. of the American Assoc of Physics Teachers), Columbia, SC, October 2019.
2. *Dissipative-regime measurements as a tool for confirming and characterizing near-room-temperature superconductivity*, M. N. Kunchur, 'Towards Room Temperature Superconductivity' Workshop, Los Angeles, CA, May 2017.
3. *Neurophysiology of time resolution in human hearing*, M. N. Kunchur, USC Neuroscience Community Retreat, Columbia, SC, May 2017.
4. *Superconductivity and oscillatory magnetoresistance at a topological-insulator/chalcogenide interface*, M. N. Kunchur, 61st Annual DAE Solid Solid State Physics Symposium, Bhubaneshwar, India, Dec 26-30, 2016.
5. *Superconductivity at a topological-insulator/chalcogenide interface probed through current-induced depairing*, M. N. Kunchur, Energy Materials Nanotechnology (EMN) meeting in Prague, Czech Republic, June 21—24, 2016.
6. *Dissipative and fast-timescale phenomena in superconductors*, M. N. Kunchur, U.S. Department of Energy, ECMP Meeting in Gaithersburg, Maryland, Sept. 28—30, 2015.
7. *Short-timescale and high-current effects in superconductors,* M. N. Kunchur, Collaborative conference on 3D and Materials Research (CC3DMR), Busan, South Korea, June 15-19, 2015.
8. *Dissipative and fast time-scale studies*, M. N. Kunchur, Collaborative Conference on Materials Research (CCMR), Incheon-Seoul, South Korea, June 23–27, 2014
9. *Limitations in current density and dissipation in superconductors*, M. N. Kunchur, International Conference on Superconductivity for Energy, Paestum, Italy, May 15-19, 2014.
10. *Novel transport phenomena in thin superconducting films in parallel magnetic fields*, M. N. Kunchur, Collaborative Conference on Materials Research (CCMR) 2014, Seoul, South Korea, June 23—27, 2014.
11. *The mixed state in the confined geometry of parallel fields in thin films*, M. N. Kunchur, NATO International Conference on Electron Correlation in Nanostructures (ECN-2013), Yalta, Ukraine, October 3–6, 2013.
12. *The Vortex Explosion Transition, M. N. Kunchur,* 57th Annual DAE-SSPS (Department of Atomic Energy – Solid State Physics Symposium) in Mumbai, India, Dec. 3–7, 2012.
13. *Some neurophysiological mechanisms that can influence the time resolution of hearing and some psychophysical*

experiments used to evaluate those auditory thresholds, M.N.Kunchur, 128th AES Convention, London, U.K., May 2010.

14. *The ballistic acceleration of the supercurrent in a superconductor*, M. N. Kunchur, NATO Advanced Research Workshop on Physical Properties of Nanosystems, Yalta, Ukraine, September 2009.
15. *The ballistic acceleration of the supercurrent in a superconductor*, M. N. Kunchur, Joint JSPS-ESF International Conference on Nanoscience and Engineering in Superconductivity, Tsukuba, Japan, March 2009.
16. *The anomalous flux dynamics of MgB_2*, M. N. Kunchur, NATO Advanced Research Workshop on Electronic Transport in Nanosystems, Yalta, Ukraine, September 18, 2007.
17. *The anomalous flux dynamics of MgB_2*, M. N. Kunchur, Superconductivity Conference at UASLP, San Louis Potosi, Mexico, August 31, 2007.
18. *A new hybrid type I -- type II superconductivity in magnesium diboride*, M. N. Kunchur, 51st DAE Solid State Physics Symposium, Bhopal, India, December 27, 2006.
19. *Unusual transport characteristics of superconducting MgB_2 microbridges,* M. N. Kunchur, JSPS/ESF International Conference on "Vortex matter in nanostructured superconductors", Crete, Greece, September 2005.
20. *The perception and high fidelity reproduction of music,* M. N. Kunchur, 2005 Annual March Meeting of the APS, Los Angeles, CA, March 2005.
21. *Dissipation due to vortex motion in superconductors,* M. N. Kunchur, Third International Symposium on "Future Oriented Interdisciplinary Materials Science … ", Tsukuba, Japan, November 2004.
22. *Current-Induced Pair Breaking in Magnesium Diboride*, M. N. Kunchur, 2003 Annual Meeting of the Southeastern Section of the American Physical Society (SESAPS).
23. *Hot-electron Instability and Flux Fragmentation*, M. N. Kunchur, International Workshop on Unconventional Superconductors, Campinas, Brazil, May 20-24, 2003.
24. *Hot-electron instability in vortex motion,* M. N. Kunchur, 2003 APS March Meeting in Austin, March 5, 2003.
25. *Unstable and Nascent Vortices*, M. N. Kunchur, Carolina Vortex Workshop, Columbia, October 19, 2002.
26. *Instabilities and other effects in highly driven vortex motion,* M. N. Kunchur, International Conference on Modern Problems of Superconductivity, Yalta, Ukraine, September 12, 2002.
27. *Unstable vortex motion in superconductors at low temperatures,* M. N. Kunchur, 19th General Conference of the EPS Condensed Matter Division, Brighton, United Kingdom, April 9, 2002.
28. *Instabilities and other Effects in the Supersonically Driven Vortices,* M. N. Kunchur, Workshop on Vortex Dynamics and Dissipation in High-T_c Superconductors, Budapest, Hungary, April 26, 2001.
29. *Unstable Flux Flow and the Normal State of YBaCuO at Low Temperatures,* M. N. Kunchur, 2000 APS March Meeting in Minneapolis, March 22, 2000.
30. *Nonlinear Flux Flow at Low Temperatures,* M. N. Kunchur, Workshop on the Microscopic Structure and Dynamics of Vortices in Unconventional Superconductors, Dresden, March 1, 2000.
31. *Vortex Instability and the Normal State at Low Temperatures,* M. N. Kunchur, Sixth International Conference on Materials and Mechanisms of Superconductivity, Houston, Feb. 24, 2000.
32. *High-frequency Effects in Superconductors from Short-Duration DC pulses*, M. N. Kunchur, ``Advances in superconductivity and its Applications to Microwaves'' (ASAM'98) conference, Delhi, Dec.14, 1998.
33. *High-power measurements of vortex dynamics*, M. N. Kunchur, Midwest Superconductivity Consortium Summer School, W. Lafayette, July 25, 1997.
34. *Transport Behavior in Superconductors at Extreme Dissipation Levels,* M. N. Kunchur, ``International Symposium on Advances in Superconductivity: New Materials, Critical Currents, and Devices'', Mumbai, September 18, 1996.
35. *Novel Transport Behavior in the Dissipative Regime of $YBa_2Cu_3O_7$,* M. N. Kunchur, 1994 Fall MRS meeting in Boston, MA, November 30, 1994.
36. *Mixed-State Transport at High Current Densities,* M. N. Kunchur, "Workshop on Statics and Dynamics of Vortices in Superconductors", LT-20 conference, Eugene, Oregon, August 1--3, 1993.
37. *Free Flux Flow in $YBa_2Cu_3O_7$ Films,* M. N. Kunchur, 1993 APS March meeting in Seattle, WA, March 1993**.**

Plenary Presentations at Meetings of the Southern Atlantic Coast Section of the Am. Assoc. of Phys. Teachers: 10

General Contributed Presentations at Conferences: 45

Colloquia and seminars

1. University of South Carolina School of Medicine, May 30, 2018 (Neuronet colloquium).
2. University of California at Los Angeles, Department of Electrical Engineering, May 10, 2017 (seminar).
3. Palmetto Richland Memorial Hospital (televised to other hospitals), December 11, 2014 (Neurology Grand Rounds).
4. Francis Marrion University, Department of Physics and Astronomy, February 27, 2014 (colloquium).
5. Univ. of South Carolina, Dept. of Physics and Astronomy, on January, 2013 (colloquium).
6. Indian Institute of Science Education and Research (IISER), December 18, 2012 (colloquium).
7. College of Charleston, Department of Physics and Astronomy, October 20, 2011 (colloquium).
8. Univ. of South Carolina, Electrical Engineering Dept., February 2, 2010 (guest lecture).

9. National Chemical Laboratory, Pune, Dec. 13, 2010 (colloquium).
10. Fergusson College, Physics Department, Pune, Dec. 11, 2010 (colloquium).
11. S. P. College, Physics Department, Pune, Dec. 16, 2010 (colloquium).
12. University of Georgia, Department of Physics and Astronomy, October 8, 2009 (colloquium).
13. University of Georgia, Department of Physics and Astronomy, October 8, 2009 (seminar).
14. University of Pune, Department of Physics, January 3, 2009 (seminar).
15. University of Pune, Department of Physics, January 1, 2009 (colloquium).
16. Indian Institute of Science Education and Research (IISER), January 5, 2009 (colloquium).
17. Tata Institute of Fundamental Research, December 26, 2008 (seminar).
18. Indira Gandhi Centre for Atomic Research (IGCAR), December 22, 2008 (seminar).
19. Indira Gandhi Centre for Atomic Research (IGCAR), December 23, 2008 (colloquium).
20. Univ. of South Carolina, Dept. of Physics and Astronomy, on October 23, 2008 (colloquium).
21. Northern Illinois University, Department of Physics, April 18, 2008 (colloquium).
22. Argonne National Laboratory, Materials Science Division, April 15, 2008 (seminar).
23. University of South Carolina Nanocenter, January 23, 2008 (seminar).
24. Universidad Autonoma de San Luis Potosí, Mexico, August 29, 2007 (colloquium).
25. Oak Ridge National Laboratory, (colloquium) August 21, 2007.
26. Oak Ridge National Laboratory, (seminar) August 20, 2007.
27. University of South Carolina, (colloquium) February 15, 2007.
28. University of Pune, (colloquium) January 5, 2007.
29. University of Pune, (colloquium) January 4, 2007.
30. Tata Institute of Fundamental Research, (colloquium) December 22, 2006.
31. Tata Institute of Fundamental Research, (seminar) December 21, 2006.
32. Bhabha Atomic Research Centre, (seminar) December 19, 2006.
33. Bhabha Atomic Research Centre, (colloquium) December 18, 2006.
34. University of South Carolina, (colloquium) September 22, 2005.
35. University of California at Irvine, (seminar) March 22, 2005.
36. Columbia Student Chapter of the Audio Eng. Society, (guest lecture) February 21, 2005.
37. Iowa State University, (seminar) December 7, 2004.
38. Iowa State University, (colloquium) December 6, 2004.
39. University of Georgia, (seminar) October 14, 2004.
40. University of Georgia, (colloquium) October 14, 2004.
41. Tata Institute of Fundamental Research, (seminar1) August 11, 2004.
42. Tata Institute of Fundamental Research, (seminar2) August 11, 2004.
43. Bhabha Atomic Research Centre, (seminar1) 9, Mumbai, August 2004.
44. Bhabha Atomic Research Centre, (seminar2) August 9, 2004.
45. University of Pune, (colloquium) August 6, 2004.
46. University of Pune, (seminar) August 7, 2004.
47. Rutgers University, (seminar) October 28, 2003.
48. Rutgers University, (colloquium) October 29, 2003.
49. Argonne National Laboratory, June 11, 2003.
50. University of South Carolina, Department of Physics and Astronomy, March 20, 2003.
51. University of South Carolina, Department of Physics and Astronomy, October 17, 2002.
52. University of Cambridge, U.K., April 12, 2002.
53. University of Georgia, February 6, 2002.
54. University of Maryland, College Park, July 9, 2001
55. ETH, Zurich, Switzerland, May 29, 2000.
56. University of Tubingen, Tubingen, Germany, May 25, 2000.
57. University of Virginia, Department of Physics, October 14, 1999.
58. University of Georgia, Department of Physics and Astronomy, September 23, 1999.
59. Clemson University, Department of Physics and Astronomy, August 26, 1999.

60. Oak Ridge National Laboratory, Solid State Division, July 22, 1999.
61. University of South Carolina, Department of Electrical Engineering, June 3, 1999.
62. University of South Carolina, Department of Physics and Astronomy, April 15, 1999.
63. University of South Carolina, Department of Chemistry and Biochemistry, Feb. 1, 1999.
64. Bhabha Atomic Research Centre, Mumbai, December 24, 1998.
65. Tata Institute of Fundamental Research, Mumbai, December 22, 1998.
66. College of Charleston, Charleston, September 29, 1998.
67. University of Kansas, Lawrence, April 23, 1998.
68. University of Michigan, December 10, 1996.
69. Ohio State University, October 23, 1996.
70. University of Cincinnati, October 16, 1996.
71. Indian Institute of Technology, Powai/Mumbai, October 9, 1996.
72. University of Pune, Pune, October 2, 1996.
73. National Chemical Laboratory, Pune, September 30, 1996.
74. Indian Institute of Science, Bangalore, September 24, 1996.
75. Society for Applied Microwave Electronics and Engineering Research, Mumbai, Sept. 13, 1996.
76. Bhabha Atomic Research Centre, Mumbai, September 11, 1996.
77. University of Dayton, April 19, 1996.
78. University of South Carolina, April 11, 1996.
79. Georgetown University, November 30, 1995.
80. Wright State University, October 13, 1995.
81. Clemson University, April 27, 1995.
82. Cornell University, April 21, 1995.
83. University of Tennessee, Knoxville, February 20, 1995.
84. University of Minnesota, January 31, 1995.
85. Iowa State University, January 26, 1995.
86. University of Illinois at Urbana-Champaign, January 24, 1995.
87. Argonne National Laboratory, January 23, 1995.
88. Rutgers University, September 27, 1994.
89. University of Pittsburgh, April 26, 1994.
90. Carnegie-Mellon University, March 18, 1994.
91. University of Virginia, March 10, 1994.
92. Purdue University, West Lafayette, October 8, 1993.
93. University of Maryland, College Park, July 1, 1993.
94. Oak Ridge National Laboratory, August 21, 1992.
95. Oak Ridge National Laboratory, June 28, 1991.
96. University of Virginia, April 1991.
97. E. I. du Pont de Nemours and Company, April 21, 1989.
98. University of Virginia, May 1988.
99. University of Illinois at Urbana-Champaign, April 1988.

Publications in journals, books, etc.

1. *High-end audio and the intricacies of the electronic reproduction of music,* M. N. Kunchur, invited review article in preparation for *Physics News* (2019).
2. *Evaluating Superconductors through Current Induced Depairing*, M. N. Kunchur, Condens. Matter **4**, 54 (2019).
3. *Dissipative-regime measurements as a tool for confirming and characterizing near-room-temperature superconductivity*, C. L. Dean and M. N. Kunchur, review article in *Quantum Studies: Mathematics and Foundations* **5**, 111-121 (2018).
4. *The pair-breaking current and basic parameters of the superconducting state*, M. N. Kunchur, review article in *Physics News* **47**, 19 (2017).
5. *Superconductivity and oscillatory magnetoresistance at a topological-insulator/chalcogenide interface*, C. L. Dean, M. N. Kunchur, N. Shahesteh-Mogaddam, S. D. Varner, J. M. Knight, B. I. Ivlev, Q. L. He, H. Liu, J. Wang, R. Lortz, and I. K. Sou, *AIP Conf. Proc.* **1832**, 020001 (2017).
6. *Anomalous oscillatory magnetoresistance in superconductors*, M. N. Kunchur, C. L. Dean, and B. I. Ivlev,

Phys. Rev. B **94**, 054504 (2016).

7. *Current driven vortex-antivortex pair breaking and vortex explosion in the Bi2Te3/FeTe interfacial superconductor*, C. L. Dean, M. N. Kunchur, Q.L. He, H. Liu, J. Wang, R. Lortz, I.K. Sou, *Physica C* **527**, 46 (2016).
8. *Energy Losses in Superconductors*, C. L. Dean and M. N. Kunchur, *J. of Power and Energy Eng.* **4**, 20 (2016).
9. *Current induced depairing in the Bi2Te3/FeTe interfacial superconductor*, M. N. Kunchur, C. L. Dean, N. Shayesteh Moghadam, J. M. Knight, Q. L. He, H. Liu, J. Wang, R. Lortz, I. K. Sou, and A. Gurevich, *Phys. Rev. B* **92**, 094502 (2015).
10. *Pinning mechanism in electron-doped HTS NdCe0CuO epitaxial films*, A. Guarino, A. Leo, G. Grimaldi, N. Martucciello, C. Dean, M. N. Kunchur, S. Pace, and A. Nigro, *Supercond. Sci. Technol.* **27**, 124011 (2014).
11. *The mixed state in the confined geometry of parallel fields in thin films*, M. N. Kunchur, M. Liang, C. Dean, A. Gurevich, refereed book chapter in *"Electron Correlation in Nanostructures"*; Springer-Verlag, NATO Science Series; J. Bonca and S. Kruchinin (Eds.); 1st Edition (2014).
12. *Depairing current density of Nd2-xCexCuO4-d superconducting films*, M. N. Kunchur, C. Dean, M. Liang, N. S. Moghaddam, A. Guarino, A. Nigro,G. Grimaldi, A. Leo, *Physica C* **495**, 66 (2013).
13. *Depairing current density of infinite-layer Sr1-xLaxCuO2 superconducting films*, M. Liang, M. N. Kunchur, L. Fruchter, Z.Z. Li, *Physica C* **492**, 178 (2013).
14. *The Vortex Explosion Transition,* M. N. Kunchur, M. Liang, and A. Gurevich, *AIP Conf. Proc.* **1512**, 19 (2013).
15. *Thermally activated dynamics of spontaneous perpendicular vortices tuned by parallel magnetic fields in thin superconducting films,* M. N. Kunchur, M. Liang, and A. Gurevich, *Phys. Rev. B* **86**, 024521 (2012).
16. *Non-Linear and Unstable Flux Vortex Dynamics,* M. N. Kunchur, M. Liang, J. Hua, and Z. Xiao, *AIP Conf. Proc.* **1349**, 911 (2011).
17. *Transient response of a superconductor in an applied electric field,* M. N. Kunchur and G. F. Saracila, Ch. no. 10, pg. 129 in*"Physical Properties of Nanosystems"*, NATO Science for Peace and Security Series B: Physics and Biophysics; Bonca, Janez; Kruchinin, Sergei (Eds.); 1st Edition, IX, 350 p., Hardcover; ISBN: 978-94-007-0043-7 (2011).
18. *Vortex instability in molybdenum-germanium superconducting films*, M. Liang and M. N. Kunchur, *Phys. Rev. B* **82**, 144517 (2010).
19. *Evaluating free flux flow in low-pinning molybdenum-germanium superconducting films*, M. Liang, M. N. Kunchur, J. Hua and Z. Xiao, *Phys. Rev. B* **82**, 064502 (2010).
20. *Ballistic acceleration of a supercurrent in a superconductor*, G. F. Saracila and M. N. Kunchur, *Phys. Rev. Lett.* **102**, 077001 (2009).
21. *Time evolution of a supercurrent during an applied voltage*, M. N. Kunchur and G. F. Saracila, *Proceedings of the 53rd DAE Solid State Physics Symposium*, **53**, 907 (2008).
22. *Probing the temporal resolution and bandwidth of human hearing*, M. N. Kunchur, *Proc. of Meetings on Acoustics* **2**, 050006 (2008).
23. *Temporal resolution of hearing probed by bandwidth restriction*, M. N. Kunchur, *Acta Acustica united with Acustica* **94**, 594–603 (2008).
24. *High-field flux dynamics in disordered two-band superconductivity,* J. M. Knight and M. N. Kunchur, chapter no. 7, pg. 71 in *"Electron Transport in Nanosystems"*, Eds. J. Bonca and S. Kruchinin, Springer Publishers, Dordrecht, The Netherlands (2008).
25. *Flux flow in a two-band superconductor with delocalized electric fields,* J. M. Knight and M. N. Kunchur, *Phys. Rev. B* **77**, 024516 (2008).
26. *Audibility of temporal smearing and time misalignment of acoustic signals,* M. N. Kunchur, *Technical Acoustics*, 17 (2007).
27. *Hybrid type I—type II superconducting behavior in magnesium diboride,* M. N. Kunchur, G. Saracila, D. A. Arcos, Y. Cui, A. Pogrebnyakov, P. Orgiani, and X. X. Xi, *Proceedings of the 51st DAE Solid State Physics Symposium*, Bhopal, India, December (2006).
28. *Energy relaxation at a hot-electron vortex instability,* J.M. Knight and M. N. Kunchur, *Phys. Rev. B* **74**, 64512 (2006).
29. *Anomalous flux dynamics in magnesium diboride films,* M. N. Kunchur, G. Saracila, D. A. Arcos, Y. Cui, A. Pogrebnyakov, P. Orgiani, X. X. Xi, P. W. Adams, and D. P. Young, *Physica C* **437**-438, 171-175 (2006).
30. *Dissipation and destruction of superconductivity in magnesium diboride films,* M. N. Kunchur, Proceedings of the Joint Meeting of FIMS/ITS-NS/CTC/PLASMA-2004 and the Nanoscience and Engineering in Superconductivity conference, November (2004).
31. *Suppressed flux motion in magnesium diboride films*, D. H. Arcos and M. N. Kunchur, *Phys. Rev. B* **71**, 184516 (2005).
32. *Current induced pair breaking in MgB_2* , M. N. Kunchur, Topical Review in *J. Phys.: Cond. Matter* **16**, R1183-R1204 (2004).
33. *Mixed-state transport characteristics of magnesium diboride films*, M. N. Kunchur, C. Wu, D. H. Arcos, G. Saracila, Eun-Mi Choi, Kijoon H.P. Kim, W. N. Kang, and Sung-Ik Lee, *Braz. J. Phys.* **33**, 705 (2003).
34. *Critical flux pinning and enhanced upper-critical-field in magnesium diboride films,* M. N. Kunchur, C. Wu, D. H. Arcos, B. I. Ivlev, Eun-Mi Choi, Kijoon H.P. Kim, W. N. Kang, and Sung-Ik Lee, *Phys. Rev. B* **68**, 100503 (2003).
35. *The pair-breaking critical current density of magnesium diboride,* M. N. Kunchur, Sung-Ik Lee, and W. N. Kang, *Phys. Rev. B* **68**, 064516 (2003).
36. *Hot-electron instability in superconductors*, M. N. Kunchur and J. M. Knight, *Mod. Phys. Lett.* **B** 17, 549 (2003).

37. *Unstable flux flow due to heated electrons in superconducting films*, M. N. Kunchur, *Phys. Rev. Lett.* **89**, 137005 (2002).
38. *Shear fragmentation of unstable flux flow*, M. N. Kunchur, B.I. Ivlev, and J. M. Knight, *Phys. Rev. B* **66**, 060505 (2002).
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EVIDENCE OF RESEARCH LEADERSHIP AND RECOGNITION

Excerpts from grant-proposal reviews

"Prof. Kunchur appears to be a very capable scientist with exceptional experimental skills. As noted, he has established himself as an acknowledged leader in pulsed studies of superconductors."

"This is a scientific goldmine that has been relatively unexplored...The PI is uniquely qualified to perform these studies. Indeed, the PI has pioneered this field, and he might be the best researcher in the world capable of doing a thoughtful and deep analysis of what is happening in these extreme regimes. It is a very imaginative proposal, proposing to do very difficult experiments, that nobody else could do as well as the PI. He is the top expert in these type of important studies... not blindly following the bandwagon, but boldly going where few others are going. This requires courage, and not so many scientists are doing this."

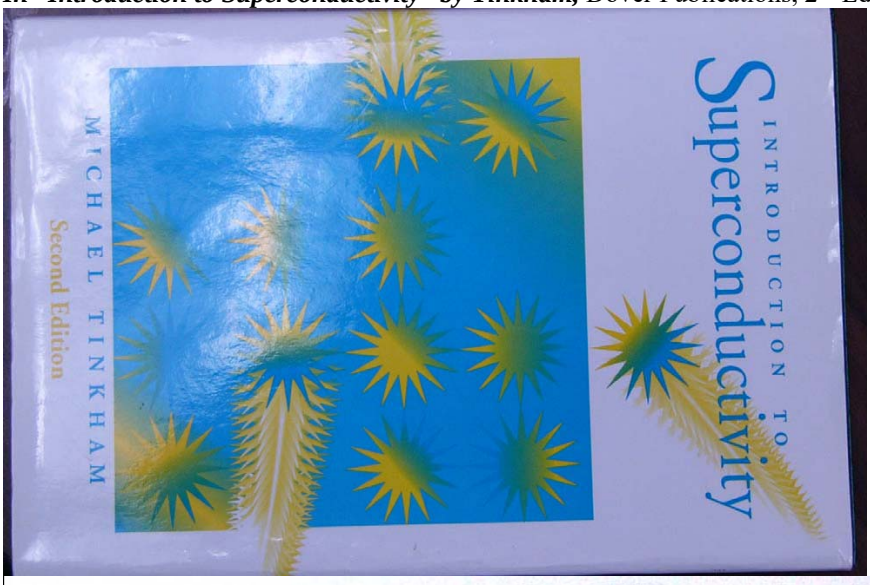
"The PI touches on a wide variety of effects... addresses an impressively broad spectrum of non--equilibrium physics...strengths of the proposal are the PI's formidable expertise ... "

"...this group is basically the only one in this country capable of performing such experiments...As with any bold exploratory work... surprises and unexpected discoveries are likely. The capable USC group led by the expert PI has an excellent track record of accomplishments under the prior DOE funding...The results have been published extensively and reported by the PI in several invited talks at international conferences...actively involving undergrads and minority students and participating in the APS sponsored outreach program."

"...topics break new ground ...scientifically, it probes new extreme conditions which have not yet been explored."

Few examples of work cited in textbooks, newsletters, and magazines

In "Introduction to Superconductivity" by Tinkham, Dover Publications, 2nd Edition (2004), ISBN-13: 978-0486435039



Substituting this in (5.53), we obtain for the flow resistance ρ_f

$$\frac{\rho_f}{\rho_n} = \frac{2\pi a^2 B}{\Phi_0} = \left(\frac{a}{\xi}\right)^2 \frac{B}{H_{c2}} \approx \frac{B}{H_{c2}} \qquad (5.59)$$

In writing the final approximate equalities in (5.58) and (5.59), we have used the fact that we expect the core radius a to be approximately equal to ξ. If we simply set $a = \xi$, ρ_r joins smoothly onto ρ_n at H_{c2}, which is reasonable since the transition there is of second order. Experimental data generally follow this simple result (5.59) reasonably well. By using short current pulses to minimize the heating effects of intense currents, Kunchur et al.[15] have recently demonstrated quantitative agreement with (5.59), provided the current is high enough to overwhelm pinning forces completely.

...would not result from a simple static distribution

In "Music in the Human Experience: Introduction to Music Psychology", Hodges & Sebald
Publisher: Routledge (December 10, 2010), ISBN-10: 0415881862, ISBN-13: 978-0415881869

Chapter 6

Musical Hearing

HEARING is often considered the most important sense in humans (Carey, 2008). Whether it is or not, a thorough understanding of the physiology of the hearing mechanism is essential to understanding many aspects of musical behavior, because it is primarily the sense of hearing that makes music possible. Three elements are needed for the perception of sound to take place—a source of vibrations, a medium of transmission, and a perceiver. The first two elements were discussed in the previous chapter; this chapter includes a discussion of the third element—the perception of sound. In the following pages, a sound wave will be traced from outside the ear to the brain and the perception of psychological attributes of sound will be discussed.

Throughout this discussion, the reader is urged to keep in mind the incredible sensitivity of the hearing mechanism and its extreme miniaturization. For instance, one can perceive sound when the eardrum has been deformed as little as one-tenth the diameter of a hydrogen molecule (Everest, 1986). The softest sounds we can hear result from air pressure changes of two ten-billionths of atmospheric pressure (Watson, 2009), and the ratio of the loudest sound we can hear to the softest is more than a trillion to one (Schroeder, 1993). Kunchur (2008) found that listeners could discern temporal alterations on a time scale of five milliseconds. One of the bones of the middle ear, the stirrup, is the smallest in the human body at "about half the size of a grain of rice" (Stevens & Warshofsky, 1965, p. 35) and Reissner's membrane in the cochlea is only two cells thick (Gulick, Gesheider, & Frisina, 1989). This marvelous engineering should give musicians and all others who enjoy the sounds they hear a feeling of awe and appreciation.

In "Studies of High Temperature Superconductors", by A. Narlikar
Nova Science Publishers (May 1, 2002) ISBN: 978-1-59033-342-6

At temperatures below about T_c /2 the VIC's displayed steps in the NDR regime. Each step appeared to be due to the nucleation of a high-electric-field domain with a distinct final size. This generation of a series of individual high-electric-field domains with increasing applied voltage observed in the YBCO films [42] is clearly different than the growth process of a single high-electric-field domain in NCCO [39] we have discussed in Chapter 6. Whereas the microscopic origin of this domain formation in YBCO still needs to be clarified, it appears to be likely that the underlying mechanisms in NCCO and in YBCO have some common ingredients.

8. SUMMARY AND CONCLUSIONS

The change of the quasiparticle energy distribution in the mixed state of a superconductor due to the electric field generated by vortex motion leads to nonlinear effects in the damping of the vortex motion. As a result, the flux-flow VIC's display NDR regimes which can be

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World Scientific, p. 238 (April 13, 1994). ISBN-10: 9810216386, ISBN-13: 978-9810216382

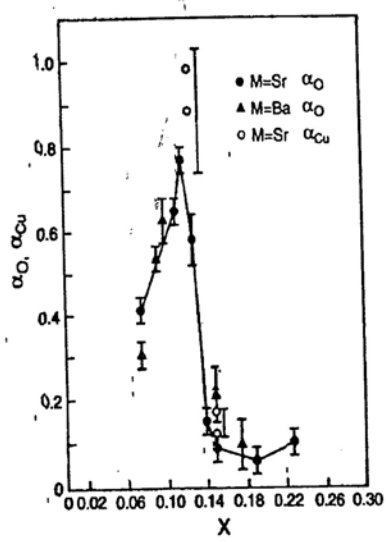

Fig. 21: The oxygen isotope exponent α_O for $La_{2-x}Sr_xCuO_4$ as function of Sr concentration. After Ref. (91,92). The copper isotope exponent α_{Cu} is also shown, after Ref. (93).

Ref. 91: *Anomalous oxygen isotope effect in $La_{2-x}Sr_xCuO_4$*, M. K. Crawford, **M. N. Kunchur**, W.E.Farneth, E.M.McCarron, and S.J.Poon, Phys. Rev. B 41, 282 (1990).

Principle contributions:
Crawford: Far-infrared measurements
Kunchur: Measurement of Tc shift and determination of isotope exponent
Farneth: $O^{16} \rightarrow O^{18}$ isotope exchange
McCarron: Preparation of LaSrCuO superconducting powders

In High Temperature Superconductors and Other Superfluids, *by A. S. Alexandrov and N. F. Mott, Taylor & Francis, p. 128 (Nov 24, 1994). ISBN-10: 0748403094, ISBN-13: 978-0748403097*

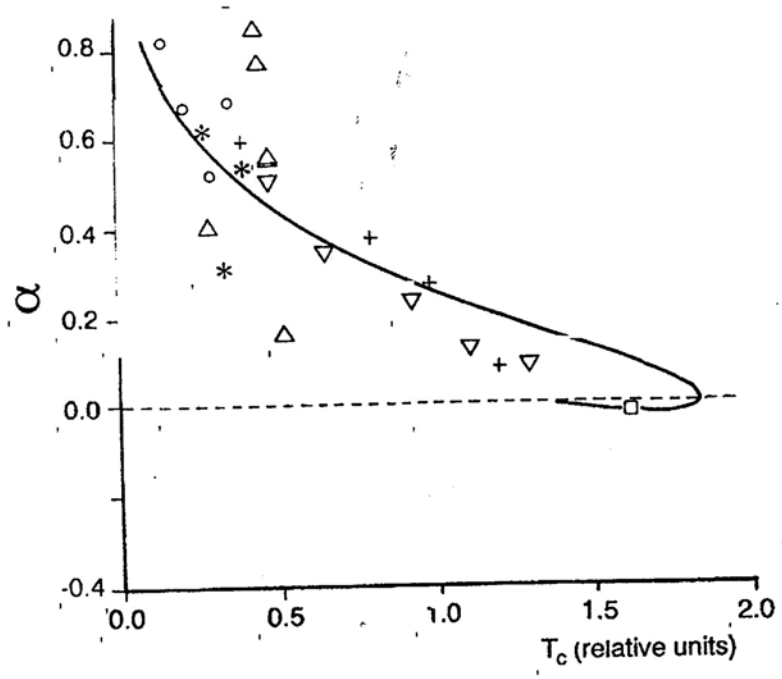

Fig.7.10. Oxygen isotope effect:(o)$La_{2-x}Ca_xCuO_4$, ($\triangle$)$La_{2-x}Sr_xCuO_4$, (*)$La_{2-x}Ba_xCuO_4$ (Crawford *et al.* (1990)); (∇)$Y_{1-x}Pr_xBa_2Cu_3O_{6.92}$ (Franck *et al.* (1991)); (+)$YBa_2Cu_{4-x}Ni_xO_8$ (Bornemann *et al.* (1991a)); ($\square$)$Bi-Pb-Ca-Sr-Cu-O$ (Bornemann *et al.* (1991b)). Theoretical curve after Alexandrov (1992a).

Data from: *Anomalous oxygen isotope effect in* $La_{2-x}Sr_xCuO_4$, M. K. Crawford, **M. N. Kunchur**, W.E.Farneth, E.M.McCarron, and S.J.Poon, Phys. Rev. B 41, 282 (1990).

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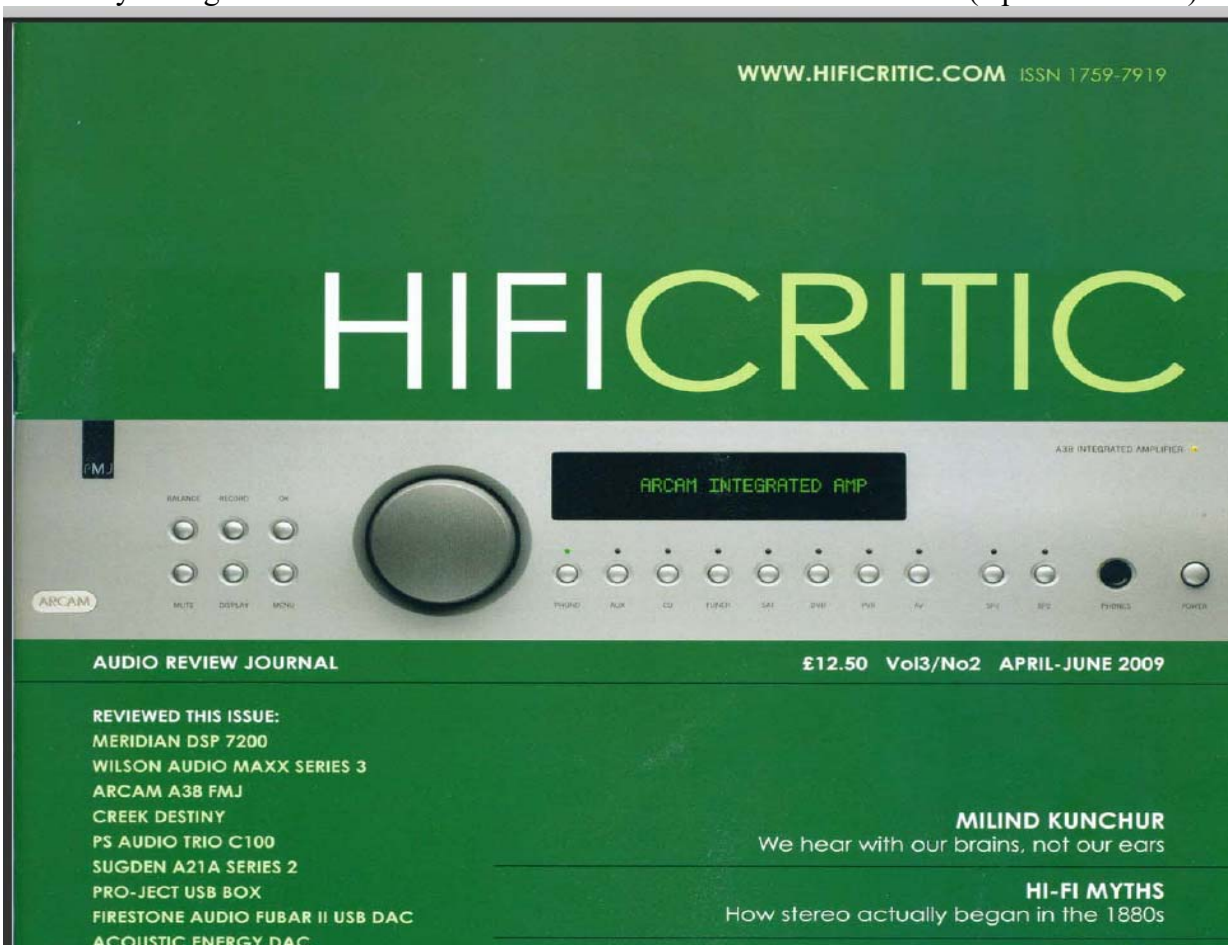
Article by George Foster about Kunchur's acoustics research in *HiFiCritic* (April-June 2009)



Milind Kunchur

MEASURING WHAT WE VALUE OR VALUING WHAT WE CAN MEASURE? AN INTRODUCTION TO THE WORK OF MILIND KUNCHUR. BY GEORGE FOSTER

GEORGE FOSTER

Imagine you are inside a large metal bin. There is a cotton sheet stretched over the opening. Passers-by throw tennis balls onto the sheet. The balls are of different hardness, arrive at different velocities and come from different directions. Some are thrown directly at your sheet; others are tossed on at random. From the impact of the balls you have to identify the individuals throwing them, pinpoint their location, recognise their direction and interpret their attitude toward you. And you have to do all this instantly.

Recognise the process? This description, based on one in Daniel Levitin's book *This is Your Brain on Music*, is an illuminating insight into the complexity of the brain's task in processing the impact of molecules of air against our eardrums. (It's a sobering thought that if my ancestors had not developed these capabilities in their hostile natural environments, some predator would have eaten them, and I wouldn't be around to write this.)

The complexity of this natural attribute is often overlooked, and there's a tendency in hi-fi to underestimate the importance of the brain in listening, because it's notoriously difficult to measure what goes on in your head, particularly when it comes to hearing. Frequently someone claims to hear subtleties that other people either cannot hear, or even refuse to believe exist. The differences between CD transports feeding the same DAC, or sound differences across a range of cables, fall into this

than10kHz. When tested a few years ago my own hearing was limited to 15kHz, while CD has an upper limit of 20kHz and SACD typically 45kHz. I can't hear dog-whistles, but I sure can hear the differences between CD and higher resolution formats. I can also hear when one CD transport plods through a Bill Evans' piano trio, which had just sounded delicate and swinging on another. I experience these effects, but cannot measure them or satisfactorily explain why in terms that would satisfy those members of the hi-fi community who demand double blind tests for all. I've come across people and writers who see issues which they cannot measure and explain as delusions or deceit, or even worse, as *anecdotal* – which now seems to mean the very opposite of scientific.

(Anyone remember the Guardian's "Bad Science" column on power cables? Be prepared to be incensed by: http://www.badscience.net/2006/01/sounding-out-the-hi-fi-kettle-leads/.)

Enter Milind Kunchur

Milind Kunchur is a physics professor at the University of South Carolina. Besides teaching a course called *Physics 155: Musical Acoustics*, he divides his time between researching superconductivity in nanowires (*ie* measuring tiny currents in tiny structures), and looking at the capabilities of the hearing system and the brain

Few examples of *Nota Bene* citations in *High-Tc Update* of Prof. Kunchur's work:

Vortices

Intense pulsed current densities have been used by M. N. Kunchur (South Carolina) et al. to overcome vortex pinning in $YBa_2Cu_3O_{7-\delta}$ down to low temperatures ($T/T_c \sim 0.02$) and drive flux flow to the point of vortex instability over the entire temperature range. The critical resistivity at the point of instability ρ^* is proportional to B and shows good agreement with $\rho^* \approx 2\rho_f \approx 2\rho_n B/H_{c2}$. Contrary to some speculation, ρ_n saturates to a residual value, much like an ordinary metal, and the vortex dissipation continues to be conventional as $T \to 0$.

Lattice Monte Carlo simulations (5×10^4 hours of a single Cray node's capacity) have been used by K. Kajantie (Helsinki) et al. to study the interactions and macroscopic behavior of a large number of vortices in the three-dimensional U(1) gauge+Higgs field theory in an external magnetic field. The authors studied both type-I and type-II superconductors and obtained results relevant for superconductors, some models of cosmic strings, and the electroweak phase transition in a magnetic field.

Other Activities

The transport critical current J_c in a polycrystalline superconductor is known to be a hysteretic function of the applied magnetic field because of intragranular flux trapping. This effect has been observed by several groups, and attempts have been made to calculate the intergranular field H_i as a function of the applied field H_0 in terms of an effective geometrical demagnetization factor D. In general, a first-principles calculation of D is very difficult, and moreover D is not constant but rather a hysteretic function of H_0. A paper by M. N. Kunchur (South Carolina) and T. R. Askew (Kalamazoo and Argonne) describes a self-consistent scheme to extract D and H_i directly from the $J_c(H_0)$ data. The authors apply this model to analyze data on sintered $YBa_2Cu_3O_{7-\delta}$ rods.

As noted by M. N. Kunchur (South Carolina) et al., the time-dependent Ginzburg-Landau approach qualitatively justifies the decomposition of the Hall angle in the mixed state into two terms, one proportional to field (as in a normal metal) and the other weakly dependent on field. The authors compare the theory with experimental data and find rough quantitative agreement.

The relaxation of a nonequilibrium normal domain in a superconductor has been studied by M. Ghinovker et al. (Bar-Ilan). The authors found both analytically and numerically that relaxation leads to