ANAND BHATTACHARYA

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email: anand@anl.gov Date: Oct. 1, 2022.

Education:

- Ph.D., Physics, University of Minnesota, July 1999
  Thesis title: "Nonlinear Transverse Magnetic Moment of High Temperature Superconductors as a Probe of the Pairing State Symmetry."
- M.Sc., Physics (Integrated 5 yr. degree), I.I.T. Kanpur, India, July 1993

Employment and Appointments:

- Physicist, Materials Science Division, Argonne National Laboratory, July 2010 – current date (RD3, RD4, RD5)
- Deputy Director, Center for Topological Semimetals (CATS) Energy Frontier Research Center (Sept. 2022 – ongoing).
- Senior Scientist Affiliate, University of Chicago Consortium for Advanced Science and Engineering (UChicago CASE) Nov. 2019 - ongoing.
- Physicist, Center for Nanoscale Materials, July 2010 – September 2016.
- Assistant Scientist, Center for Nanoscale Materials (CNM), Argonne National Laboratory , June 2007 to June 2010 (RD2).
- Assistant Physicist, Materials Science Division, Argonne National Laboratory , July 2006 – June 2010 (RD2).
- Visiting Scientist, Materials Science Division, Argonne National Laboratory, July 2004 to June 2006.
- Post-Doctoral Research Associate, Physics Department, University of Minnesota, July 1999 - July 2004 (mentor: Prof. Allen M. Goldman)
- Research Assistant, Physics Department, University of Minnesota, Jan. 1995 - June 1999 (thesis advisor: Prof. Allen M. Goldman)
- Teaching Assistant, Physics Department, University of Minnesota, Aug. 1993 - Dec. 1994.

Awards and Fellowships:

- Physical Science and Engineering Excellence Award, Programmatic Scientific Achievement for 2021, Argonne National Laboratory.
- Fellow of the American Physical Society, elected 2019.
- Aneesur Rahman Award for best Ph.D. dissertation, awarded by the Physics Department, University of Minnesota.
- Graduate Dissertation Fellowship, 1998-99, awarded by the Graduate School, University of Minnesota.
- Foster Wheeler Fellowship 1997-98, awarded by the Graduate School, University of Minnesota.
- National Talent Search scholar, India 1988-1993

Invited Presentations:

1. Invited Talk, 29th International Conference on Low Temperature Physics, Aug. 18-24, 2022, Sapporo Japan, "Two-dimensional superconductivity at $KTaO_3$ interfaces and its origins".
2. Invited Talk, 13th International Conference on Materials and Mechanism of Superconductivity & High Temperature Superconductors (M2S-2022), July 17-22, 2022, Vancouver, Canada, "Two-dimensional superconductivity at $KTaO_3$ interfaces and its origins".
3. Invited Talk, Twelfth Workshop on Competing Interactions and Colossal Responses in Transition Metal Oxides and Related Compounds, June 21-25, 2022, Telluride, Colorado, "Two-dimensional superconductivity at $KTaO_3$ interfaces and its origins".
4. Invited Talk, Spin Caloritronics XI, May 23-27, 2022, UIUC, Urbana-Champaign IL, Sensing and control of sublattice dynamics of an insulating antiferromagnet using electrical means".
5. Invited Talk, APS March Meeting, Mar 14-18, 2022, Chicago "Two-dimensional superconductivity at $KTaO_3$ (111) interfaces and its origins"
6. Invited Talk, Electronic Materials and Applications, Jan 18-22, 2022, Orlando, Florida. "Discovery of two-dimensional superconductivity at $KTaO_3$ (111) interfaces"
7. Invited Talk, 34th International Symposium on Superconductivity (ISS2021), Nov 30, 2021, Japan,"Discovery of two-dimensional superconductivity and nematic electronic states at $KTaO_3$ (111) interfaces".
8. Invited Talk, iWOE27, Genoa, Italy, Oct 13th, 2021,"Discovery of two-dimensional superconductivity and nematic electronic states at $KTaO_3$ (111) interfaces".
9. Invited Talk, DOE PI Meeting on Experimental Condensed Matter Physics, Sept. 20th, 2021, "Two-dimensional superconductivity and nematic electronic states at $KTaO_3$ (111) interfaces".
10. Quantum Matters Seminar, University of Chicago, Sept. 17th, 2021, "Two-dimensional superconductivity and nematic electronic states at $KTaO_3$ (111) interfaces".
11. Invited Talk, CEMS Topical Meeting: Interface Oxide Phenomena Meet Novel Growth Techniques, RIKEN (Wako), Japan, July 16th, 2021,"Discovery of two-dimensional superconductivity and nematic electronic states at $KTaO_3$ (111) interfaces".
12. Lunch Time Seminar, Center for Nanoscale Materials, Argonne National Laboratory, March 26, 2021, "Discovery of two-dimensional superconductivity and nematic electronic states at $KTaO_3$ (111) interfaces".
13. Invited Talk, DOE PI Meeting on Physical Behavior of Materials, March 11, 2021, "Two-dimensional superconductivity and nematic electronic states at $KTaO_3$ (111) interfaces".

14. Center for Quantum Materials Seminar, University of Minnesota, March 2nd 2021. "Two-dimensional superconductivity and nematic electronic states at $KTaO_3$ (111) interfaces".

15. Invited Talk, International Conference "Quantum Materials Heterostructures-2" organized by INST Mohali/IIT Roorkee India, Feb 19, 2021, "Discovery of two-dimensional superconductivity and nematic electronic states at $KTaO_3$ (111) interfaces".

16. Condensed Matter Seminar, University of Texas at Austin, Feb. 11, 2021, "Two-dimensional superconductivity and nematic electronic states at $KTaO_3$ (111) interfaces".

17. Invited Talk, "QUOROM-3", Feb 11, 2021, "Discovery of two-dimensional superconductivity and nematic electronic states at $KTaO_3$ (111) interfaces".

18. Materials Science and Engineering Seminar, North Carolina State University, Jan 29, 2021, "Discovery of two-dimensional superconductivity and nematic electronic states at $KTaO_3$ (111) interfaces".

19. Invited Talk, "Sensing and control of the spin sublattices of Cr_2O_3 by electrical means", MRS Fall Meeting Dec. 2nd, 2020.

20. Invited Talk, "Epitaxial films of Kagome metals", CATS EFRC Mini-Workshop on Mn_3X Materials, Aug. 19th, 2020.

21. Invited Talk, "Films of $MnBi_2Te_4$: a brief review", CATS EFRC Mini-Workshop on $MnBi_2Te_4$ Compounds, June 30th, 2020.

22. Invited Talk, "Sensing and control of the spin sublattices of Cr_2O_3 by electrical means", Intermag 2020, Montreal Canada (Cancelled due to COVID-19).

23. Condensed Matter Seminar, "Some new findings in superconductivity in $SrTiO_3$ and $KTaO_3$", Department of Physics, University of Notre Dame, Sept 3rd 2020.

24. Invitation to speak at "Metallicity, superconductivity and ferroelectricity in quantum paraelectrics", Sept 4-5, 2020 near Bonn, Germany (conference postponed due to COVID-19)

25. Invitation to speak at "International Workshop on Complex Oxides, June 18-22, 2020, Spetses, Greece. (conference postponed due to COVID-19).

26. Invited Talk, "Superconductivity in the single band limit in reduced $SrTiO_3$", Microscopics of Superconductivity in Perovskite Oxides: Challenges, Hurdles and Enigmas (MISPOCHE), May 4th 2020 (organized online by Univ. Geneva/Bar-Ilan University and Nordita).

27. Invited Talk, "Meeting a strange metal: $LaNiO_3$", 7th International Symposium on Integrated Functionalities (ISIF 2019), Dublin Ireland, Aug 12th, 2019.

28. Invited Talk, "Meeting a strange metal in thin films of $LaNiO_3$", Competing Interactions and Colossal Responses in Transition Metal Oxides, Telluride CO, June 28, 2019.

29. Condensed Matter Physics Seminar, "Meeting a strange metal (or two): $LaNiO_3$ and $SrTiO_{3-d}$", Department of Physics and Astronomy, Northwestern University, May 30th, 2019.

30. Invited Talk, "Meeting a strange metal in thin films and heterostructures of $LaNiO_3$", APS March Meeting 2019, Boston, March 5th, 2019.

31. Condensed Matter Physics Seminar, "$LaNiO_3$ – a strange metal on the cusp of magnetism", Department of Physics, University of California at Riverside, Jan. 11, 2019.

32. Condensed Matter Seminar, Department of Physics, Iowa State University "Probing non-collinear magnetic states using thermal gradients", Ames Iowa, Nov. 16, 2017.

33. Invited Talk "Novel magnetic states revealed in thermogalvanic measurements in oxide single crystals and superlattices", IUMRS-ICAM 2017, Kyoto, Japan, Aug. 30, 2017.

34. Invited Talk, "Playing with oxygen in O_3-MBE : a tale of 3 pressures", ACCGE21-OMVPE18 Crystal Growth Meeting, Santa Fe NM, Aug. 15, 2017.

35. Invited Talk "Spin Seebeck Effect in the absence of Ferromagnetism", Competing Interactions and Colossal Responses in Transition Metal Oxides, Telluride CO, June 27, 2017.

36. Invited Talk "Spin Seebeck Effect in the absence of Ferromagnetism", CNM/APS Users Meeting, Argonne National Laboratory, May 8, 2017.

37. Invited Talk "Tailoring non-collinear magnetism in oxide heterostructures – a path to novel memory", APS March Meeting 2017, New Orleans LA, March 17th 2017.

38. Invited Talk, "Novel magnetic states revealed in thermogalvanic measurements in patterned structures", Materials Research Society Fall Meeting, Boston Dec 1st 2016.

39. Invited Talk at Synthesis Processing and Science PI Meeting, organized by DOE BES, Gaithersburg MD, Nov. 2nd 2015.

40. Invited Talk at Experimental Condensed Matter Physics PI Meeting, organized by DOE BES, Gaithersburg MD, Sept. 28th 2015.

41. Invited Talk at SPIE Optics + Photonics 2015, San Diego CA, Aug 12th 2015.

42. Invited Talk at TSRC Conference Competing Interactions and Colossal Response in Transition Metal Oxides, Telluride CO, June 12th, 2015.

43. Departmental Seminar, Materials Science and Engineering, Carnegie Mellon University, Pittsburgh PA, Jan 23rd 2015.

44. Colloquium, Department of Physics, Boston College, Boston, Nov. 19th 2014.

45. Invited Talk at 59th Annual Magnetism and Magnetic Materials Conference, Hawaii, Nov 3-7, 2014.

46. Colloquium, Physics Department, USF Tampa, October 31st 2014.

47. Invited Talk at 'International Workshop on Complex Oxides - Santorini 3 in Cyprus', Cyprus May 22nd, 2014.

48. Colloquium, Materials Department and Materials Research Laboratory, UC Santa Barbara Oct. 25th, 2013.

49. Invited Talk, Workshop on Oxide Electronics, Singapore Sept. 23rd 2013 (Presented by Brittany Nelson-Cheeseman, since I could not attend)

50. Invited Talk, Competing Interactions and Colossal Responses in Transition Metal Compounds, Telluride, July 18th, 2013.

51. Invited Talk, Physics of Emergent Correlated Materials, Telluride, June 7th, 2013.

52. Colloquium, Center for Nanoscale Materials, Argonne, Apr. 4th, 2013.

53. Colloquium, Department of Materials Science and Engineering, University of Pennsylvania, Feb. 14th, 2013.

54. Departmental Seminar, Cavendish Laboratory, Cambridge University, Feb 28th, 2013.

55. Invited Talk, Thomas Young Center – ANL Meeting on Theory of Complex Oxide Interfaces, Argonne, Jan. 21, 2013.

56. Invited Talk, Nebraska Research and Innovation Conference (NRIC) University of Nebraska, Oct. 10th 2012.

57. Invited Talk, IMPACT Conference, U. Paris Sud, Orsay, France Sept. 12th 2012 (Talk delivered by Peter Littlewood on my behalf).

58. Condensed Matter Seminar, Department of Physics, Purdue University, Aug 24th 2012.

59. Condensed Matter Seminar, University of British Columbia, Vancouver, Canada June 17th, 2012.

60. Condensed Matter Physics Seminar, Department of Physics and Astronomy, University of Minnesota, Minneapolis, Sept. 15th, 2011.

61. Colloquium, Department of Physics and Astronomy, University of Minnesota, Minneapolis, Sept. 14th, 2011.

62. Invited Talk, Oxide Interfaces Workshop, IBM Almaden, Aug 30th 2011.

63. Invited Talk, DOE Condensed Matter Physics Contractors' Meeting, August 12th 2011.

64. Invited Talk, Competing Interactions and Colossal Responses in Transition Metal Compounds, Telluride, July 17, 2011.

65. Condensed Matter Physics Seminar, Michigan State University, East Lansing, May 2nd 2011.

66. Invited Talk, Villa Conference on Complex Oxide Heterostructures, Las Vegas, April 23rd 2011.

67. Condensed Matter Physics Seminar, University of Florida, Feb 14th 2011.

68. Invited Talk, Conference on the Physics and Chemistry of Surfaces and Interfaces, PCSI 38 San Diego, Jan 16th 2011.

69. Invited Talk, International Conference on Magnetism and Magnetic Materials, Saha Institute of Nuclear Physics, Kolkata, Oct 26th, 2010.

70. Condensed Matter Seminar, Department of Physics, Northwestern University, April 15th, 2010.

71. Colloquium, Department of Physics, University of Washington at Seattle, Feb. 22, 2010.

72. Condensed Matter Seminar, Department of Physics University of Texas at Austin, Feb 16th, 2010.

73. Invited Talk, JNCASR Meeting on Physics of New Materials, Kolkata India, Jan 18th 2010.

74. Invited Talk, TIFR India – Argonne US Interactive Workshop on Frontier Areas of Materials Research, Jan 12th 2010.

75. Condensed Matter Seminar, NIST Gaithersburg, Nov. 13th 2009.

76. Invited Talk, Synprosci 2009 (Synthesis and Processing DOE BES Contractors Meeting), at Warrenton VA, Oct. 27th 2009.

77. Experimental Condensed Matter Physics Seminar, Department of Physics, Ohio State University, Oct 8th 2009.

78. Invited Talk, 'Superconductivity', Conference organized in honor of Prof. Allen Goldman's career, May 2nd 2009, Minneapolis MN.

79. Invited Talk, APS March Meeting, Pittsburgh PA, March 16th 2009.

80. Colloquium, Physics Department, University of Illinois at Chicago, Feb 19th, 2009.

81. Invited Talk, Workshop on Research Frontiers and Capability Gaps for Controlling and Designing Functional Materials, Los Alamos National Laboratory, Jan 20th 2009.

82. Colloquium, Department of Physics, Northern Illinois University, Oct.10th 2008.

83. Invited Talk, Correlated Electrons Workshop, Oak Ridge National Laboratory, June 17th 2008.

84. Condensed Matter Physics Seminar, Department of Physics, Pennsylvania State University, Oct 23nd 2007.

85. Condensed Matter Physics Seminar, Department of Physics, University of Toronto, Oct 22nd 2007.

86. Invited Talk, Synprosci 2007 (Synthesis and Processing DOE BES Contractors Meeting), at Baltimore, July 9th 2007.

87. Condensed Matter Physics Seminar, Northwestern University, Nov. 15th 2006.

88. Invited Talk, International Workshop on Mesoscopic Superconductivity and Magnetism, Chicago, Sep. 30th, 2006.

89. Seminar, Materials Science Division, Brookhaven National Laboratory, Apr. 28th 2006.

90. Invited Talk, Midwest Workshop on Quantum Transport and Magnetics, Northwestern University, Mar. 28th 2006.

91. Colloquium, MSD Argonne, Feb. 10, 2005.

92. Invited Talk, Workshop on Physics of Ultrathin Films near the Metal-Insulator Transition, Brookhaven National Laboratory, Jan 6, 2005, Long Island.

93. DOE meeting on Electrostatic Gating Phenomena, Jan. 2004, Long Island.

94. Invited Talk, SPIE Annual Meeting, July 9, 2002, at Seattle. (for Prof. Allen Goldman).

95. Invited Talk, MRS Fall Meeting, December 5, 2002, at Boston. (for Prof. Allen Goldman).

Research Awards, Grants:

Current:

Lead Principal Investigator: Field Work Proposal at the Materials Science Division, Argonne: "Digital Synthesis: A Novel Pathway to New Collective States in the Complex Oxides", funded by Department of Energy, Basic Energy Sciences. Period of support: 2006 – continuing. (Primary Core Grant)

Deputy Director and Co-PI, *EFRC* "Center for Advancement of Topological Semimetals", Lead PI: Robert Mc Queeney (Ames Laboratory), *Agency*: DOE-BES; *Start Date*: Aug 2022 – July 2026 (4 yrs).

Co-Thrust Leader and Co-PI, DOE Microelectronics Proposal: "Threadworks", Lead PI: Valerie Taylor (Argonne). *Agency*: DOE BES; Oct. 1 2021 – Sept 30th, 2024.

Co-PI, Center Proposal: "Center for Predictive Simulation of Functional Materials", Lead PI: Paul Kent (ORNL). *Agency*: DOE-BES; *Start Date*: Oct 1, 2020 – Sept 2024 (4 yrs).

Prior:

Thrust Leader and Co-PI, *EFRC* "Center for Advancement of Topological Semimetals", Lead PI: Robert Mc Queeney (Ames Laboratory), *Agency*: DOE-BES; *Start Date*: Aug 2018 – July 2022 (4 yrs).

Co-PI, LDRD* Proposal 'Threadworks', Lead PI Valerie E. Taylor, MCS Argonne. Start Date: Feb 2020 – Jan 2022 (2 years).

*note: 'LDRD' stands for Laboratory Directed Research and Development. These proposals are competed internally within Argonne.

Co-PI, Center Proposal: "Center for Predictive Simulation of Functional Materials", Lead PI: Paul Kent (ORNL). *Agency*: DOE-BES; *Start Date*: Oct 1, 2016 – Sept 2020 (4 yrs).

Lead Principal Investigator: LDRD 'Innovate' proposal: "Active plasmonics using gate tunable Dirac Semimetals", co-PI's Xuedan Ma, Richard Schaller; *Agency*: Argonne National Laboratory LDRD; *Start Date*: Oct 1 2018 – Sept 2020 (2 yrs)

Lead Principal Investigator: LDRD 'Innovate' proposal: "Realizing a gate tunable kinetic inductance for a transmon qubit using $SrTiO_3$", co-PI's Jidong Samuel Jiang, Alex Martinson; *Agency*: Argonne National Laboratory LDRD; *Start Date*: Dec 1 2016 – Dec 2018 (2 yrs).

Co-PI: "Creating Next-Generation Quantum Electronics with Topological Insulator/Ferromagnetic Insulator Heterostructures," *Agency*: Argonne National Laboratory LDRD (seed grant, joint with University of Delaware); *Duration:* April 2018 – Sept. 2019

Co-PI on LDRD 'Prime' proposal: "Oxides for Novel Computational Approaches", Axel Hoffmann (Lead PI), co-PI's Dillon Fong, Anand Bhattacharya, David Awschalom, Supratik Guha, Giulia Galli; Amount: 2 years; *Agency*: LDRD; *Start date*: Oct 1, 2016 (2 yrs).

Co-PI on Strategic LDRD, Argonne National Laboratory," Synthesis Science of Functional Layered Complex Oxides". Oct 2010- 2013 *Role*: modify existing MBE system with in-situ synchrotron x-ray scattering capability for synthesis of layered oxides."

Lead PI – Instrumentation Grants to develop a new MBE Lab in Materials Science Division: This was a multi-year effort involving several internal competitions over which I was able to secure funding for a new film growth lab using Molecular Beam Epitaxy (MBE) in the Materials Science Division. This custom designed system consists of two MBE systems and a sample annealing/preparation chamber connected by a sample transfer system.

Professional Activities:

Journal Referee

Journals include *Applied Physics Letters*, *Nature, Nature Physics*, *Nature Materials*, *Nature Communications*, *Physical Review Letters*, *Physical Review* X, *Physical Review* B, *Science Advances, Journal of Materials Research*, *Journal of Magnetism and Magnetic Materials*, *Nanotechnology, Nano Letters, Advanced Materials, Advanced Functional Materials.*

Proposal Review*:*

DOE Early Career Proposals (2012 - ongoing).

DOE BES (DMSE) Reviewer for University and National Laboratory Programs (2013 – ongoing).

NSF CAREER Award Panel Review, Condensed Matter Physics, 2020.

NSF Proposal Review Panel for EPM/ECCS in the Divisions of Materials Research and Engineering, Jan 2011; Divisions of Materials Research and Engineering, June 2014.

NSERC, Canada (Discovery Grants Program) 2013, 2019.

ERC, Europe (Advanced Grant), 2013.

User proposals at SNS and HFIR neutron scattering facilities at Oak Ridge National Laboratory, APS Argonne, CNM Argonne, 2DCC Penn State (ongoing).

Conference and Workshop Organization*:*

APS March Meeting Focus Sessions coordinator for DMP (as part of executive committee responsibilities) 2020-2023

Co-Organizer, CATS EFRC Mini-Workshop on Mn_3X Materials, Aug. 19th, 2020.

Best Student Presentation Award Committee Chair, MMM-Intermag 2013.

Focus Topic Co-Organizer, "Magnetic Oxide Thin Films", with Chris Leighton, Yayoi Tonomura, APS 2013.

Focus Sessions Co-Organizer (with Lane Martin, Manuel Bibes and John Freeland) for APS March 2011,: "Magnetic Oxide Thin Films", Dallas TX.

Workshop co-organizer (with John Freeland): " Analysis and Control of Defects in Complex Oxides", Argonne National Laboratory, July 27th-28th, 2010.

Program Committee for MMM-Intermag 2010.

Symposium Co-organizer (with Chris Leighton) : "Reconstruction And Emergence at Interfaces of Complex Oxides", MMM Nov. 2008 (Austin TX).

Workshop Co-organizer (with Matthias Bode) : "Emergent States at Interfaces of Complex Oxides: What can be learnt from local probes?", CNM User Week, Argonne, May 7th and 8th, 2008.

Committees

James McGroddy Prize for New Materials Selection Committee, American Physical Society, 2023.

Member-at -Large, Executive Committee, Division of Materials Physics, American Physical Society, 4/20 – 03/23

APS Fellowship Selection Committee, Division of Materials Physics American Physical Society, 2021.

Richard L. Greene Dissertation Award Selection Committee, American Physical Society for 2021 and 2022.

Thesis Prelim Examination Committee for Eugene Ark, Department of Physics, UIUC (2022).

Member, Staff Scientist Search Committee, Materials Science Division, Argonne National Laboratory, Sept. 2020 – ongoing.

Chair, Staff Scientist Search Committee, Materials Science Division, Argonne National Laboratory, August 2019 – January 2020.

Chair, Colloquium Committee, Materials Science Division, Argonne National Laboratory, March 2011 – January 2013.

Thesis Committee for Amish Shah, Ph. D Candidate, Department of Materials Science and Engineering, University of Illinois at Urbana Champaign 2010.

Outreach:

- Member of '*Physics Force, Next Generation*', lecture demonstration team at the University of Minnesota (led by Prof. James Kakalios, Prof. Cynthia Cattell).
- Assisted the Center for Nanoscale Materials at Argonne with demonstrations and lab tours for visitors, including college and high-school students, and other dignitaries.

Current Postdoctoral Advisees:

Dr. Qianheng Du (Ph.D. Stonybrook University): Postdoctoral Research Associate, Oct 2020 – present.

Dr. Junyi Yang, (Ph.D. University of Tennessee): Postdoctoral Research Associate, June 2022 – present.

Dr. Hanu Arava (Ph.D. ETH Zurich): Postdoctoral Research Associate, June 2022 – present.

Current Graduate Student Advisee:

Eugene Ark, Physics UIUC (jointly with Prof. Vidya Madhavan) Feb 2018 - present

Former Postdoctoral Advisees:

Dr. Steve J. May (Ph.D Northwestern University): Postdoctoral Research Associate, Feb 2007 – Aug 2009. Currently Professor and Chair of Materials Science, Drexel University, Philadelphia.

Dr. Tiffany S. Santos (Ph.D MIT): CNM Distinguished Postdoctoral Fellow, Sept. 2007 – 2010. Dr. Santos was offered the L'Oreal USA Women in Science National Fellowship for 2009. Currently Technologist at Hitachi Global Storage Technologies Research, San Jose CA.

Dr. Brittany B. Nelson-Cheeseman (Ph.D, U.C. Berkeley): Postdoctoral Research Associate July 2009 – July 2012. Currently Assoc. Professor in Mechanical Engineering, University of St. Thomas, St. Paul MN.

Dr. Jason Hoffman (Ph.D. Yale University): Postdoctoral Research Associate, October 2010 – October 2014. Currently Research Associate in Prof. Jenny Hoffman's group in Department of Physics, Harvard University, Boston MA.

Dr. Ming Liu (Ph.D Northeastern University): Directors Postdoctoral Fellow, April 2011 – July 2012. After his postdoc, Dr. Liu joined the Air Force Research Laboratory in Dayton Ohio as a Staff Scientist. Currently Professor of Electrical and Information Engineering (selected as part of the 'Thousand Talents' program) at Xi'an Jiaotong University, Xi'an China.

Dr. Stephen Mingda Wu (Ph.D U.C. Berkeley): Postdoctoral Research Associate, July 2013 – November 2016. Currently Assistant Professor, Department of Electrical and Computer Engineering, University of Rochester, Rochester NY.

Dr. Terence Bretz-Sullivan (Ph.D. University of Minnesota): Postdoctoral Research Associate, Jan 2017 – Nov. 2019. Currently Staff Scientist, Sandia National Laboratories, Sandia NM.

Dr. Friederike Wrobel (Ph.D University of Stuttgart): Postdoctoral Research Associate, April 2017 – Dec 2019. Currently Staff Scientist, Intel Corporation.

Dr. Naween Anand (Ph.D University of Florida): Postdoctoral Research Associate, June 2019 – Sept. 2021. Currently Testing Engineer, Intel Corporation.

Dr. Deshun Hong (Ph.D Institute of Physics, Chinese Academy of Sciences, Beijing) Postdoctoral Research Associate, Feb. 2017 – December 2021. Faculty, Materials Science, Chonqing University, China.

Dr. Changjiang Liu (Ph.D. University of Minnesota): Postdoctoral Research Associate, November 2016 – January 2022. Faculty, Department of Physics, University at Buffalo, NY.

Short term visitors - Undergraduate and Masters Students*:*

Summer Students:

Lukasz Wojtaszek (UIUC), summer of 2008;

Ian Broderick (Carleton), summer of 2009;

Sarah Schlotter (Carleton) summer 2010;

Fedor Titov (Cornell) summer of 2015.

Masters Thesis Student*:*

Philippe Hauser, ETH Zurich, May 2012 – Oct. 2012

Facilities and User Support:

Designed an Oxide MBE system for synthesis of complex oxide superlattices that was installed in the Center for Nanoscale Materials at Argonne in 2007, and was used for synthesis of epitaxial films, heterostructures and superlattices until 2019.

Publications

Google Scholar: https://scholar.google.com/citations?user=kL-RSZAAAAAJ&hl=en

Journal Publications:

1. "Synthesis of antiferromagnetic Weyl semimetal Mn_3Ge on insulating substrates by electron bean, assisted molecular beam epitaxy", Deshun Hong, Changjiang Liu, Jianguo Wen, Qianheng Du, Brandon Fisher, J. S. Jiang, John E. Pearson and Anand Bhattacharya, accepted, *APL Mater*. **10** (2022).

2. "Tunable superconductivity at the oxide-insulator/$KTaO_3$ interface and its origin", Changjiang Liu, Xianjing Zhou, Deshun Hong, Brandon Fisher, Hong Zheng, John Pearson, Dafei Jin, Michael R Norman, Anand Bhattacharya, arXiv:2203.05867 (submitted).

3. "Nanoscale Control of the Metal-Insulator Transition at $LaAlO_3$/$KTaO_3$ Interfaces", Muqing Yu, Changjiang Liu, Dengyu Yang, Xi Yan, Qianheng Du, Dillon D Fong, Anand Bhattacharya, Patrick Irvin, Jeremy Levy, *Nano Letters* **22**, 6062 (2022).

4. "Origin of the 2D Electron Gas at the $SrTiO_3$ Surface", Xi Yan, Friederike Wrobel, I-Cheng Tung, Hua Zhou, Hawoong Hong, Fanny Rodolakis, Anand Bhattacharya, Jessica L McChesney, Dillon D Fong, *Advanced Materials* **34**, 2200866 (2022).

5. "Self-healing Growth of $LaNiO_3$ on a mixed-terminated perovskite surface", Yan Li, Friederike Wrobel, Yingjie Cheng, Xi Yan, Hui Cao, Zhongying Zhang, Anand Bhattacharya, Jirong Sun, Hawoong Hong, Huanhua Wang, Yuzi Liu, Hua Zhou, Dillon D Fong, *ACS Appl. Mater. Interfaces* **14**, 16928 (2022).

6. "On the Development oof Order and Interfaces during the Growth of Ultrathin La_2CuO_4 films by Molecular Beeam Epitaxy", Hawoong Hong, Xinyue Fang, Friederike Wrobel, Meng-Kai Lin, Zhan Zhang, Kevin M Peterson, Anand Bhattacharya, Dillon D Fong, Tai-Chang Chiang, *ACS Applied Electronic Materials* **3**, 5124 (2021).

7. "Voltage control of magnon spin currents in antiferromagnetic Cr_2O_3", Changjiang Liu, Yongming Luo, Deshun Hong, Steven S-L Zhang, Brandon Fisher, John E Pearson, J Samuel Jiang, Axel Hoffmann, Anand Bhattacharya, *Science Advances* **7**, eabg1669 (2021).

8. "Two-dimensional superconductivity and anisotropic transport at $KTaO_3$ (111) interfaces", Changjiang Liu, Xi Yan, Dafei Jin, Yang Ma, Haw-Wen Hsiao, Yulin Lin, Terence M Bretz-Sullivan, Xianjing Zhou, John Pearson, Brandon Fisher, J Samuel Jiang, Wei Han, Jian-Min Zuo, Jianguo Wen, Dillon D Fong, Jirong Sun, Hua Zhou, Anand Bhattacharya, *Science* **371**, 716-721 (2021) (see arXiv:2004.07416 for related paper).

9. "Molecular beam epitaxy of PdO on MgO (001)", Deshun Hong, Changjiang Liu, Linlin Wang, Jianguo Wen, John E. Pearson, Anand Bhattacharya, *Physical Review Materials* **5**, 044205 (2021).

10. "Interface creation in a mixed-terminated perovskite surface", Yan Li, Friederike Wrobel, Xi Yan, Anand Bhattacharya, Jirong Sun, Hawoong Hong, Hua Zhou, Huanhua Wang, Dillon D Fong, *Applied Physics Letters* **118**, 061601 (2021).

11. "Anomalous Hall and Nernst Effects in FeRh", Hilal Saglam, Changjiang Liu, Yi Li, Joseph Sklenar, Jonathan Gibbons, Deshun Hong, Vedat Karakas, John E Pearson, Ozhan Ozatay, Wei Zhang, Anand Bhattacharya, Axel Hoffmann, *(submitted)* arXiv: 2012.14383

12. "Distinguishing antiferromagnetic spin sublattices via the spin Seebeck effect", Yongming Luo, Changjiang Liu, Hilal Saglam, Yi Li, Wei Zhang, Steven S-L Zhang, John E Pearson, Brandon Fisher, Anand Bhattacharya, Axel Hoffmann *Phys. Rev.* B *(R)* **103**, L020401 (2021) (*Editors' Suggestion*).

13. "Molecular beam epitaxy of the magnetic kagome metal FeSn on $LaAlO_3$ (111)", Deshun Hong, Changjiang Liu, Haw-Wen Hsiao, Dafei Jin, John E Pearson, Jian-Min Zuo, Anand Bhattacharya, *AIP Advances* **10**, 105017 (2020).

14. "In-situ X-ray and electron scattering studies of oxide molecular beam epitaxial growth", Xi Yan, Friederike Wrobel, Yan Li, Hua Zhou, Huan-hua Wang, Anand Bhattacharya, Jirong Sun, Hawoong Hong, and Dillon D. Fong, *APL Mater* **8**, 101107 (2020).

15. "Observation of an antiferromagnetic quantum critical point in high-purity $LaNiO_3$", Changjiang Liu, Vincent FC Humbert, Terence M Bretz-Sullivan, Gensheng Wang, Deshun Hong, Friederike Wrobel, Jianjie Zhang, Jason D Hoffman, John E Pearson, J Samuel Jiang, Clarence Chang, Alexey Suslov, Nadya Mason, MR Norman, Anand Bhattacharya, *Nature Communications* **11**, 1 (2020).

16. "Large anomalous Nernst and inverse spin-Hall effects in epitaxial thin films of Mn_3Ge", Deshun Hong, Naween Anand, Changjiang Liu, Haihua Liu, Ilke Arslan, John E. Pearson, Anand Bhattacharya, and J. S. Jiang, *Phys. Rev. Mater.* **4**, 094201 (2020).

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