

Joel E. Moore

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EMPLOYMENT **Department of Physics, University of California, Berkeley**

Assistant Professor, 2002-; Associate Professor, 2007-; Professor, 2011-
Chern-Simons Professor, 2016-; Interim Chair, Spring 2017

Materials Sciences Division, Lawrence Berkeley National Laboratory

Joint Faculty Scientist, 2002-; Senior Faculty Scientist, 2017-present

Theoretical Physics Section, Bell Labs, Murray Hill, NJ

Postdoctoral Member of Technical Staff, 2001

Institute of Theoretical Physics, University of California, Santa Barbara

Graduate Fellow, Fall 2000

U.S. Fulbright Student Program, TIFR (Mumbai, India), 1995-1996

EDUCATION **Department of Physics, MIT**

Ph.D., February 2001.

Thesis: ‘Phase transitions and symmetry breaking in quantum Hall edge states’

Princeton University

A.B. in Physics *summa cum laude*, May 1995

Certificate in applied and computational physics

RESEARCH

My primary area of research is in how new collective phenomena emerge from the quantum mechanics of electrons in solids. These include new kinds of order as well as new particles and forces between them. Two specific advances where my work was influential were in the understanding of how ordinary bulk materials can host states of electronic matter governed by topology, and in understanding how entanglement and other quantum information ideas appear in quantum dynamics and computing. I maintain interests in classical and quantum statistical physics more broadly, including applications to fluids and ultracold atomic gases.

PUBLICATIONS
(SUMMARY)

My work is primarily published in more than 200 scientific journal articles, including papers in the *Nature* series, the Physical Review journals, and *Science*. I have written four book chapters and a number of less technical reviews and commentaries. A textbook co-authored with Roderich Moessner, “Topological Phases of Matter”, was published in 2021 by Cambridge University Press. I was named a Clarivate Highly Cited Researcher for each of the years 2018-2021. An automated Google Scholar profile currently shows h-index of 71 and more than 25,000 total citations.

HONORS AND AWARDS

US National Academy of Sciences, 2022; Chern-Simons Professorship, UC Berkeley, 2016-present; Perimeter Institute Distinguished Visiting Research Chair, 2014-2017; Simons Investigator, 2013-present; Fellow, American Physical Society, 2014; Japan Society for the Promotion of Science Fellowship (Institute for Solid State Physics, Tokyo), 2007–2008; Hellman Fellowship, 2003–2004; NSF CAREER award, 2003.

Fannie and John Hertz Fellowship, 1996-2000; NSF Fellowship (declined); MIT K. T. Compton Fellowship; Kusaka Memorial Prize (Princeton physics award), 1993–1994, 1994–1995; elected to Phi Beta Kappa, Sigma Xi, 1995.

TEACHING

I have taught a variety of regular courses at Berkeley, ranging from modern physics for beginning engineers (Physics 7C) to graduate courses on statistical physics and many-body theory. I have also taught special topics courses on quantum materials at the graduate and undergraduate levels, which led to the textbook mentioned above, and once a freshman seminar on the physics and history of nuclear reactions. I have given occasional outreach talks at levels from kindergarten up to high school, and helped with outreach programs at Berkeley's Lawrence Hall of Science.

I have also given lecture series as part of advanced schools for graduate students at MIT, IISc Bangalore, Capri, Rio, NHMFL, Les Houches, Munich. In my teaching, I try to ensure that students with various levels of preparation all benefit from the course, and to bring even to undergraduate courses some of the excitement at the frontiers of research. Regarding methodology, I combine what I learned in an American Association of Physics Teachers workshop for beginning faculty members with what I observed to work in my own student days at Princeton and MIT. It was a valuable experience to lead a course entirely online for the first time in Fall 2020.

DEI WORK

My commitment to diversity, equity, and inclusion (DEI) begins with the students and postdocs of my research group. The eight doctoral students I currently supervise include three women and one transgender person. At the postdoctoral level, women who have passed through my group are now in faculty positions at Caltech and Tel Aviv University, and I have supervised two scientists born in Mexico who are now in faculty positions at Kent State and the Technion. As interim chair, I organized the first faculty appointment for a woman in the history of the prominent astrophysics group within Berkeley Physics.

I have also been increasingly involved in DEI work at Berkeley outside my home department. The suggestion to name an undergraduate dormitory at Berkeley for the distinguished Black mathematician David Blackwell originated with me during my service on an Academic Senate committee. I previously served as the lead Physics advisor for Cal NERDS, a program aimed at creating a diverse STEM workforce by providing a support network for Berkeley undergraduates. At the national level, I contributed to diversity efforts by the Aspen Center for Physics and the American Physical Society during my time on the management boards of those institutions.

I currently serve as a Core Advisor of Berkeley's Faculty Link program (2020-present), organized through the Office of Faculty Equity and Welfare. Berkeley has a unique and important role to play in enhancing access to an excellent scientific education and the remarkable opportunities it unlocks, including the opportunity of an academic career.

ADMINISTRATIVE SERVICE

Berkeley (selected)

Vice Chair for Faculty, Department of Physics, 2014-2018; Interim Chair, Spring 2017;

service as Chair, Policy and New Appointments committee, 2008-2015, including responsibility for departmental self-study for an external review.

Member, Academic Senate Committee on Academic Planning and Resource Allocation, 2018-2019; Courses of Instruction, 2022-present.

Co-chair, Chancellor's Advisory Council for Physical Sciences, 2019-2021

Lawrence Berkeley National Laboratory: member, Materials Sciences Division (MSD) staff review committee and MSD Council; member of search committees for MSD Director and Molecular Foundry Director positions

National/international

Elected Member-at-Large, Division of Condensed Matter Physics, American Physical Society, 2014-2017; Member, 2019, and Chair, 2020, Buckley Prize Committee.

Member, 2018-present, and Chair, 2019-2020, Advisory Board, Kavli Institute for Theoretical Physics, UCSB

Chair of DOE roundtable report on quantum computing for materials and chemistry (2017); co-chair of Basic Research Needs in Quantum Materials report (2016). Contributor and chapter co-author of influential 2007 Basic Energy Sciences report, "Directing Matter and Energy: Five Challenges for Science and the Imagination". Numerous DOE and NSF review and planning panels.

General Member, 2010-2020, Aspen Center for Physics; roles including Chair of Program Committee and Assistant Corporate Secretary

Chief Scientist, Quantum Science Center, 2020-, Oak Ridge National Laboratory

Editorial board member of Physical Review B, Advances in Physics (UK), and other journals. Advisory or review boards for institutes in Germany and India.

SUPPORT

Current grants from DOE: lead PI of Energy Frontier Research Center "Novel Pathways to Quantum Coherence in Materials," 2018-2024; chief scientist of ORNL QSC, 2020-present; co-PI of Quantum Materials Program, LBNL. NSF: single-PI theory grant, member of new NSF CIQC center. DOD: co-PI of MURI grant "TOPFORCE" led by Susanne Stemmer, UCSB. Simons Investigatorship (2013-2023, projected). Former PI of Berkeley's Moore Foundation EPiQS Theory Center, currently co-PI of EPiQS synergy grant including DEI activities (J. Analytis lead PI).

CONFERENCES AND COLLOQUIA

By now, I have given departmental colloquia at most of the major US physics departments and invited talks at the major recurring conferences in my field, including several each at the American Physical Society March Meetings and Materials Research Society annual meetings, and at Gordon Conferences in CA, MA, and Hong Kong.

I have also given less technical lectures for a broader scientific public at the American Vacuum Society, American Physical Society, American Association for the Advancement of Science, and IEEE Aerospace AeroConf.

Of conferences I have helped organize, some that I remember fondly are the KITP program on topological phases (fall 2010), an Ettore Majorana Center conference (summer

2013) on topological matter, and the Nobel symposium on topological insulators (summer 2014). I was elected as one of two chairs of the Gordon Conference on Correlated Electrons in summer 2016. I co-organized two Aspen Center for Physics winter conferences and one summer program, and a Moore Foundation/TMS Japan joint meeting on topological materials at Berkeley's Gump Station in Moorea, French Polynesia.

MENTORING

I have chaired 19 Ph.D. theses at Berkeley: Noah Bray-Ali, Cenke Xu, Padraig Murphy, Andrew Essin, Vasudha Shivamoggi, Roger Mong, Jonas Kjäll, Gil Young Cho, Michael Zaletel, Yichen Huang, Daniel Varjas, Byungmin Kang, Aaron Szasz, Shudan Zhong, Daniel Parker, Vir Bulchandani, William Berdanier, and Tianrui Xu. I have supervised more than 20 postdoctoral researchers either singly or jointly with other Berkeley faculty, and I currently supervise eight graduate students.

My former graduate students and postdocs have taken faculty positions at Berkeley, Caltech, Princeton, UCSB, UC Riverside, Kent State, UMass, and Pittsburgh, and leading universities in Japan, Israel, Sweden, Korea, and India. I have also supervised a number of undergraduate honors theses, and those students have attended graduate schools including Berkeley, MIT (x2), Stanford, and Cambridge.