Materials Research Laboratory

University of California Santa Barbara

Materials Research Outreach Program 2023

Corwin Pavilion, Wednesday January 25th and Thursday January 26th 2023

Program and Speaker Bios

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NSF Materials Research Science and Engineering Center [DMR 1720256]

Program: Wednesday January 25th

Session Chair: Ram Seshadri		
9:00 am	Eric McFarland, UCSB	Hydrogen in the Energy Transition: Help or Hype?
9:30 am	Ananya Renuka Balakrishna, UCSB	Designing Phase Transformation Microstructures in Energy Storage Materials
10:00 am Break		
Session Chair: Angela Pitenis		
10:30 am	Nicole Schauser, Voltaiq	Data Analytics and Machine Learning for Battery Research and Development
11:00 am	Audra DeStefano, UCSB	Design of Soft Material Surfaces with Rationally Tuned Water Diffusivity
11:30 am	Patricia Holden, UCSB	Collaboratively Researching Environmental Dimensions of Nanoparticles, Fibers and Films
12:00 pm Lunch		
Session Chair: Ram Seshadri		
1:30 pm	Shelly Gable, UCSB	Good News! Celebrating Positive Moments Builds Personal and Interpersonal Resources
2:00 pm	Patrick Nalleau, LBNL	The Future of Moore's Law is at the Mercy of Improvements in Patterning Materials
2:30 pm Break		
Session Chair: Raphaële Clément		
3:00 pm	Ravit Silverstein, UCSB	Elucidating Reaction Mechanisms Governing the Synthesis of SiC-Based Matrices for Ceramic Composites
3:30 pm	Mary Scott, UC Berkeley	Algorithms for Electron Microscopy
4:00 pm	Tresa Pollock, Dean of Engineering (welcome remarks)	
4:15 pm	*Posters*	

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Program: Thursday January 26th

Session Chair: Meredith Murr		
9:00 am	Allison Chau, UCSB	Lubricity of Stimuli-Responsive Hydrogels
9:30 am	Elizabeth Murphy, UCSB	Efficient Creation and Morphological Analysis of ABC Triblock Terpolymer Libraries
10:00 am Break		
Session Chair: Chris Bates		
10:30 am	Lara Leininger, LLNL	Unique and Challenging: Energetic Materials Development at Lawrence Livermore National Laboratory
11:00 am	Sheila Mathis Hurtt, Google	III-V Innovation in Industry: An Epi Engineer's Lessons Learned
11:30 am	Rohini Gupta, BASF-CARA	Innovation at BASF
12:00 pm Lunch		
Session Chair: Alaina McGrath		
1:30 pm	Juan Chamorro, UCSB	Competing Energy Scales in Doped and Delithiated $LiRh_2O_4$
2:00 pm	Ethan McGarrigle, UCSB	Investigating the Interplay of Quantum Statistics and Spin-orbit Coupling: Emergent Superfluid Mesophases
2:30 pm	Kira Wyckoff, UCSB	Refractory Oxide Anodes for Fast-Charging Batteries
3:00 pm Break		
Session Chair: Craig Hawker		
3:30 pm	Kaitlin Albanese, UCSB	Building Tunable Degradation into Pressure-Sensitive Adhesives
4:00 pm	Andrew Cooper, Liverpool	*Cheetham Lecture*

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Kaitlin Albanese obtained her M.S. in chemistry from San Francisco State University under the guidance of Professor Ihsan Erden developing synthetic methods for sigmatropic shifts in saturated fulvene endoperoxides. After graduating, she began working for HRL Laboratories advancing high-performance polymers through molecular-level design and synthesis. In the fall of 2020, she started her Ph.D. under the supervision of Craig Hawker working on the synthesis and characterization of sustainable materials.

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Ananya Renuka Balakrishna is an Assistant Professor in the Materials Department. She received her Ph.D. in Solid Mechanics and Materials Engineering from the University of Oxford and then pursued postdoctoral research as a Lindemann Fellow at MIT (Department of Materials Science) and at the University of Minnesota (Aerospace Engineering and Mechanics). Broadly, her research focuses on the mechanics of phase transformation materials and understanding why and how microstructural patterns form in these systems.

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Juan R. Chamorro joined UC Santa Barbara in 2021 after completing his PhD in chemistry at Johns Hopkins University in Baltimore, MD, under Prof. Tyrel McQueen. His graduate work focused on the chemistry of quantum materials including topological semimetals, quantum spin liquids, and superconductors. He is part of the inaugural class of NSF MPS-Ascend Postdoctoral Fellows, and performs research under Profs. Stephen Wilson and Ram Seshadri. His work focuses on synthesizing and studying materials with electronic, magnetic, and structural instabilities at tangible energy scales, with the ultimate goal of identifying non-trivial quantum ground states.

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Allison L. Chau is a fourth-year Ph.D. candidate and NSF Graduate Research Fellow in the Materials Department at UC Santa Barbara in the Interfacial Engineering Lab of Professor Angela Pitenis. She received a B.S. in Materials Engineering from Purdue University in 2019 and graduated with highest distinction. During her undergraduate studies, Allison worked with Professor Chelsea Davis on polymer thin film delamination and dewetting. Her current research focuses on tuning the mechanical and tribological properties of hydrogels through polymerization conditions and external stimuli (e.g., light, pH).

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Andy Cooper is a Nottingham graduate (1991), obtaining his Ph.D. there in 1994 for the study of organometallic reaction mechanisms at low temperatures and high pressures with Prof. Martyn Poliakoff FRS. After his Ph.D, he held a 1851 Fellowship and a Royal Society NATO Fellowship at the University of North Carolina at Chapel Hill, USA, working with Prof. Joseph M. DeSimone on polymerization reactions and phase transfer processes in supercritical CO_2 (1995–1997). He then held a Ramsay Memorial Research Fellowship at the Melville Laboratory for Polymer Synthesis in Cambridge, working with Prof. Andrew B. Holmes FRS on polymerization in supercritical CO_2 (1997–1999). In 1998, he was awarded a Royal Society University Research Fellowship and joined Liverpool in January 1999, where he holds a Personal Chair. His main research interests are organic materials, computational materials design, robotics for labs, and high-throughput materials methodology. He is the founding Director of the Materials Innovation Factory and Director of the Leverhulme Centre for Functional Materials Design.

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Audra DeStefano is a Ph.D. candidate in the Department of Chemical Engineering at the University of California, Santa Barbara advised by Professors Rachel Segalman and Songi Han. Her research focuses on controlling the properties of hydration water using bio-inspired polymers for applications such as water purification and marine antifouling. Specifically, Audra combines sequence-defined polypeptoids with advanced magnetic resonance techniques to understand how changes in polymer chemistry and assembly impact chain conformation and local water dynamics.

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Shelly Gable received her Ph.D. in Social and Personality Psychology at the University of Rochester and began her career as an Assistant Professor at UCLA where she earned tenure and co-founded the Interdisciplinary Relationship Science Program before joining the faculty at University of California, Santa Barbara, where she is currently chair of the department. Dr. Gable's research focuses on motivation, emotions, and interpersonal relationships. She is particularly interested in the social regulation of emotions, positive processes in close relationships, and well-being and resilience more broadly. She is a fellow of the Association for Psychological Science, the Society for Personality and Social Psychology, and the International Positive Psychology Association. Her awards include the Presidential Early Career Award for Scientists and Engineers (PECASE) from President George W. Bush, and the Career Trajectory Mid-Career Award from the International Association of Relationship Researchers.

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Rohini Gupta is an Innovation Manager for CARA – California Research Alliance by BASF, with subject matter expertise in the interdisciplinary field of advanced functional materials, soft matter, colloids & interfaces, and wetting & adhesion. She graduated with honors in Chemical Engineering from Malaviya National Institute of Technology Jaipur in 2007. After receiving her Ph.D. from the Johns Hopkins University in 2013, she pursued her postdoctoral fellowship at the University of Pennsylvania and worked briefly at the Dow Chemical Company. Before becoming the Innovation Manager in 2022, she worked in the fast-paced semiconductor industry for 6 years, first as Process Technology Development Engineer for Intel Corporation and then as Scientist for BASF Corporation's Center for Excellence, Semiconductor Applications. She has received numerous awards for her outstanding technical contributions and has a prolific publication record in reputed international journals.

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Patricia (Trish) Holden is a Professor in the Bren School of Environmental Science & Management and Director of the UCSB Natural Reserve System. Her training is in Civil & Environmental Engineering (CEE; B.S., University of Tennessee and M.S., Purdue University) and Soil Microbiology (Ph.D., U.C. Berkeley) with 8 years professional CEE experience. She leads a research group studying pathogens, pollutants, and microbial processes. Research projects include: 1) synthetic microfiber, and micro- to nano-plastic, sources and environmental fates, 2) origins and fates of environmental pathogens, 3) the urban water environment (UWE): spatial relationships between urban infrastructure and subsurface contamination, 4) natural treatment systems for stormwater runoff, 5) distribution and function of subsurface soil bacteria, 6) microbial interactions with engineered nanomaterials, 7) tobacco and cannabis product pollutants, and cannabis cultivation chemicals. Holden is a Switzer Environmental Fellow.

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Lara Leininger is the Director of the Lawrence Livermore National Laboratory (LLNL) Energetic Materials Center (EMC). The EMC mission is to integrate state-of-the-art capabilities in high explosives, propellants, thermites and pyrotechnics for the benefit of the Department of Energy / National Nuclear Security Administration (DOE/NNSA) Science-based Nuclear Stockpile Stewardship Program, the Department of Defense, Department of Homeland Security, U.S. government agencies, and U.S. industry. LLNL conducts over 600 experiments annually at the High Explosives Applications Facility (HEAF) in Livermore, CA, and the Site 300 Experimental Site in Tracy, CA. Dr. Leininger joined Lawrence Livermore National Laboratory (LLNL) in 1997. Lara received her BS in Mechanical Engineering from University of California, Santa Barbara, her MS in Mechanical Engineering from Stanford University, and her PhD in Civil Engineering from University of California, Davis.

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Eric McFarland studied Nuclear Engineering and received his Ph.D. from the Massachusetts Institute of Technology. Since 1991 he has worked in catalysis and chemical reaction engineering in the Department of Chemical Engineering at UC Santa Barbara. McFarland has always worked closely with industry and he continues to serve as a Board member and advisor for several chemical technology companies. He is the founder and Chief Technology Officer of CZero developing technology to use fossil resources for low-cost hydrogen production without carbon dioxide emissions.

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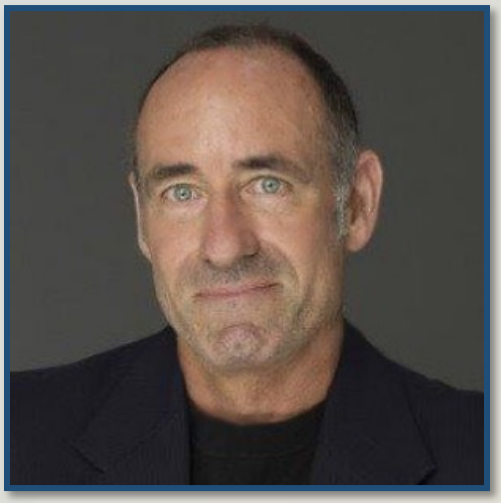

Ethan McGarrigle is a third-year PhD candidate and Mitsubishi Chemical Fellow in the Chemical Engineering department at UC Santa Barbara. He received his B.S. in Chemical Engineering at the Massachusetts Institute of Technology, where he worked under Leon Glicksman on continuum transport modeling of low-cost evaporative coolers for vegetable storage. Currently, he is advised by Professor Glenn H. Fredrickson and develops first-principles, field-theoretic simulations of spin-orbit coupled superfluids. Using methods in thermodynamics and quantum statistical mechanics, his research aims to find and characterize new superfluid phases.

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Sheila Mathis Hurtt is Director of Epitaxy Engineering at Google, following acquisition in 2022 of the startup Raxium, of which she was a principal founding leader. Based in Fremont, CA, Raxium enables next-generation display applications using its core technology innovation: monolithic integration of micron-scale InGaN-based RGB emitters in highly efficient and ultra-bright micro displays. Throughout her 20-plus year career, Sheila's has been focused on III-V epitaxial growth and its influence on materials properties and consequent optoelectronic and RF device performance. In past roles, she was the first epitaxy engineer at then-startup Infinera, which developed an entirely new telecommunications system paradigm based on the world's first large-scale InP-based photonic integrated circuits. She then moved to TriQuint (later Qorvo) and worked with III-V epitaxy companies worldwide to develop epitaxial structures and processes that enable automotive, base station and handset 4G and 5G products. Sheila received her PhD in Materials from UCSB in 2000, where she was advised by Prof. Jim Speck in the area of solid mechanics of III-V epitaxial materials, and her SB in Materials Science from MIT in 1995.

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Elizabeth Murphy is a third-year Ph.D. candidate and National Science Foundation Graduate Research Fellow at UC Santa Barbara under the advisement of Professor Craig J. Hawker and Professor Christopher M. Bates. She received her Bachelor of Science in Chemistry in 2020 at the University of Illinois at Urbana-Champaign, where she worked with Professor Paul V. Braun on zwitterionic and redox-active polymers. Prior to joining UC Santa Barbara, she interned at The Lubrizol Corporation researching polymeric viscosity modifiers for engine oil. Her graduate research focuses on the synthesis, fractionation, and self-assembly of block copolymers.

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Patrick Naulleau received his B.S. and M.S. degrees in electrical engineering from the Rochester Institute of Technology, Rochester, NY, in 1991 and 1993, respectively. He received his Ph.D. in electrical engineering from the University of Michigan, Ann Arbor in 1997 specializing in optical signal processing and coherence theory. In 1997 Dr. Naulleau joined Berkeley Lab on the EUV LLC program building the world's first EUV scanner. From June 2005 through March 2008, Dr. Naulleau additionally joined the faculty at the University at Albany, SUNY as Associate Professor, also concentrating in the area of EUV lithography. In April 2010 Dr. Naulleau took the position of Director of the Center for X-ray Optics at Lawrence Berkeley National Laboratory and in 2022 Dr. Naulleau further assumed the role of CEO at EUV Tech Inc. Dr. Naulleau has over 390 publications as well as 19 Patents and is a Fellow of OSA (now Optica) and SPIE.

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Nicole Schauser is a Battery Data Scientist at Voltaiq, the industry's first Enterprise Battery Intelligence software platform. She joined Voltaiq after completing her PhD in Materials at UC Santa Barbara, where she studied ion transport in solid polymer electrolytes for both lithium and multivalent batteries under Professors Rachel Segalman and Ram Seshadri. Her prior experience includes research and development on lithium metal and silicon anodes, as well as solid-state electrolytes. Now at Voltaiq, she leads the integration of machine learning techniques for automated data analysis and battery performance prediction, and works closely with Voltaiq's enterprise customers on their battery development programs.

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Mary Scott is the Ted van Duzer Associate Professor in the Materials Science and Engineering department at University of California, Berkeley. She is also a Faculty Staff Scientist at the National Center for Electron Microscopy, part of the Molecular Foundry at Lawrence Berkeley National Lab. She received a B.S. in Aerospace Engineering and a B.S. in Physics, followed by an M.S. in Physics, from North Carolina State University. She obtained her Ph.D. in Physics from the University of California, Los Angeles. Prof. Scott's research program seeks to combine advanced electron microscopy with modern mathematical approaches for data handling and interpretation. Examples of her work include atomic resolution electron tomography studies of nanomaterials, machine learning approaches to interpret imaging and diffraction electron microscopy data, scanning nanodiffraction studies of disordered materials, and multimodal studies of interfaces in battery materials.

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Ravit Silverstein is a research scientist in the Materials department and a manager in the Microscopy and Microanalysis Facility. Ravit received her Ph.D. in 2016 and M.Sc. in Materials Engineering from Ben-Gurion University and was a research associate at the Applied Physics Division, Soreq Nuclear Research Center. After conducting research at the Bundesanstalt für Materialforschung und prüfung, BAM (Federal Institute for Materials Research and Testing), she was a post-doctoral fellow (from 2018 until 2021) in the group of Carlos G. Levi. Her research aims to develop unique processing approaches for ceramics and metals and design advanced engineering materials via non-equilibrium structures for future high-thrust propulsion, aircraft, and hypersonic vehicles. A major component of her studies relies on spectroscopy, advanced analytical electron microscopy, in-situ S/TEM experiments, and developments of novel characterization modalities.

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Kira Wyckoff is completing her PhD at the University of California Santa Barbara in Materials Science and Engineering. She holds a Bachelor of Science in Chemical Engineering and a Master of Science in Materials. During her undergraduate studies, she helped scale up bioreactors for manufacturing biodegradable polymers at Mango Materials. Following her Master's thesis, Kira then worked for Apple on the alloy engineering team to develop recycled alloys for enclosure materials in portable electronics. During this time, Kira realized her passion for fundamental science and following Apple, returned to UC Santa Barbara for her PhD. Her research focuses on driving advancement of next-generation lithium-ion battery electrode materials and was recently awarded the UC Santa Barbara Institute for Energy Efficiency Excellence in Research Fellowship.

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