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ABOUT THE WEBINAR

The National Academies of Sciences, Engineering, and Medicine invite you to participate in a virtual town hall as part of the Decadal Survey on the Frontiers of Materials Research. During the webinar, the committee co-chairs will give a brief overview of the study and explain how you can share your input with the committee, followed by two talks from invited speakers on important issues in materials science. Paul Alivisatos will discuss his groundbreaking research on nanocrystals and Alexander H. King will discuss shortages of critical materials and how we can craft research agendas to help avoid supply disruption. These talks will be followed by a Q&A session with the audience.

ABOUT THE STUDY

The Decadal Survey on the Frontiers of Materials Research is sponsored by the Department of Energy and the National Science Foundation. The committee's final report will identify key research priorities for federal agencies that support materials research, science policymakers, and researchers in the field. Learn more about the study and share your comments with the committee at nas.edu/materials.

AGENDA

Moderator: **Gregory Boebinger**

First 10min	The three co-chairs **Laura H. Greene, Tom C. Lubensky, and Matthew Tirrell** will discuss the decadal survey and describe how you can share your input
10-25 min	**Paul Alivisatos,** Nanoparticles
25-40 min	**Alexander H. King,** Critical Materials
40-60 min	Q&A session

TALK ABSTRACTS

Paul Alivisatos – Nanoparticles

The ability to make nanocrystals of high quality (uniform size, no defects except the ones we want, designed surface, etc.) is key to this area of science, and also interesting in its own right. We grow nanocrystals with well controlled sizes and shapes by injecting molecular precursors into hot liquids that also contain molecular species that will coordinate to the growing nanoparticle surfaces. Some important questions of solid state chemistry can be addressed in the synthesis of nanocrystals. How does nucleation of a solid occur? What governs the rate of growth of each facet of a crystal? What is the stress and strain at the interface between a core and a shell of different materials?

Alexander H. King – Critical Materials

Concerns about access to materials have grown over the last decade, and the "rare earth crisis" of 2010-11 caused disquiet to governments around the world. As a result, we have seen widespread attention to critical materials, which are substances that are essential to particular technologies, but subject to supply disruption. Looking forward, there is reason to believe that shortages of critical materials may occur with increasing frequency over the next few decades. I will review some of the ways that the rare earth crisis affected the development of technology in recent years, and describe materials research agendas that can help us to avert emerging crises in the future.

SPEAKER BIOGRAPHIES

Committee Co-Chairs: Matthew Tirrell, University of Chicago and Argonne National Laboratory (Left); Laura H. Greene, National Magnet Lab and Florida State University (Center); Tom C. Lubensky, University of Pennsylvania (Right)

Paul Alivisatos is Director Emeritus of the Lawrence Berkeley National Lab and Provost of the University of California, Berkeley. He is the Samsung Distinguished Professor of Nanoscience and Nanotechnology and holds appointments in the Departments of Chemistry and Materials Science at the University of California, Berkeley. He is a founder of two prominent nanotechnology companies, Quantum Dot Corporation (now a division of Thermo Fisher), and Nanosys, Inc. Groundbreaking contributions to the fundamental physical chemistry of nanocrystals are the hallmarks of Dr. Alivisatos's career. He has elucidated the principles that allow for size and shape- controlled synthesis of nanocrystals, and performed fundamental studies of their structural, thermodynamic, optical, and electrical properties. He demonstrated the application of colloidal quantum dots in light emission devices and in biological imaging. In recognition of these accomplishments, Dr. Alivisatos has been awarded the US National Medal of Science, the Dan David Prize, and the Wolf Prize in Chemistry.

Alexander H. King is the Director of the Critical Materials Institute – one of DOE's four Energy Innovation Hubs. Although much of his research career has been spent on the minutiae of crystal lattice defects, he is now responsible for the world's largest integrated effort to assure supplies of the materials necessary for clean energy technologies. Alex holds degrees from the Universities of Sheffield and Oxford. He was a postdoc at Oxford and then M.I.T. before joining the faculty at Stony Brook University, where he also served as the Vice Provost for Graduate Studies. He has served as the Head of the School of Materials Engineering at Purdue and the Director of DOE's Ames Laboratory. King is a Fellow of the Institute of Mining Minerals and Materials; ASM International; and the Materials Research Society. He was a Visiting Fellow of the Japan Society for the Promotion of Science in 1996 and a US Department of State Jefferson Science Fellow for 2005-06. Alex was the President of the Materials Research Society for 2002, Chair of the University Materials Council of North America for 2006-07, Co-chair of the Gordon Conference on Physical Metallurgy for 2006, and Chair of the APS Interest Group on Energy Research and Applications for 2010.

Gregory S. Boebinger received Bachelors Degrees in Physics, Electrical Engineering and Philosophy in 1981 from Purdue University. He studied at Cambridge University as a Churchill Fellow, then entered the Massachusetts Institute of Technology where he held Compton and Hertz Foundation Fellowships. His thesis research utilized high magnetic fields to study the fractional quantum Hall effect with Nobel Laureates Horst Stormer and Dan Tsui. Dr. Boebinger then held a NATO Postdoctoral Fellowship in Paris at the

Ecole Normale Superieure. In 1987, Dr. Boebinger joined Bell Laboratories and established a unique pulsed magnetic field facility for physics research on semiconductors, f-electron compounds and superconductors in magnetic fields more than one-million times the Earth's magnetic field. For this research, he was named a Fellow of the American Physical Society in 1996.

Starting in 1998, Dr. Boebinger headed the pulsed magnet laboratory at Los Alamos National Laboratory, one of three campuses of the National High Magnetic Field Laboratory (MagLab). In 2004, Dr. Boebinger became director of the MagLab, with responsibility for all three campuses: Florida State University, Los Alamos National Laboratory, and University of Florida. The MagLab is the world leading magnet laboratory, used annually by more than 1700 scientists from around the world for research in physics, materials science, chemistry, biology and biomedicine. For more information, see nationalmaglab.org

Prof. Boebinger continues his own research on high-temperature superconductivity, using the intense magnetic fields to suppress superconductivity. The goal is to study the samples in the absence of superconductivity, because understanding this behavior might unravel the mystery of high-temperature superconductivity. Prof. Boebinger has published more than 110 refereed publications that have received more than 10,000 citations. Since 1984, he has presented 300 invited talks and colloquia at universities and conferences around the world. Prof. Boebinger is a Fellow of the American Association for the Advancement of Science (since 2007), and the American Academy of Arts and Sciences (since 2017).