THE DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING PRESENTS THE 2018 MORRIS E. FINE MEMORIAL LECTURE FEATURING:

Susanne Stemmer

Professor
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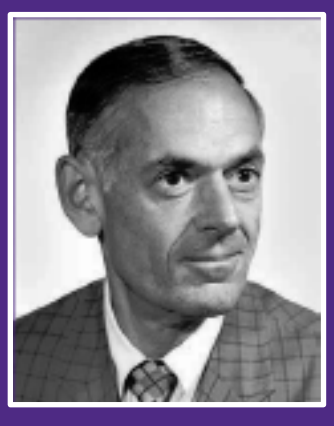
Topological Heterostructures by Molecular Beam Epitaxy

Topology, both in real space and in reciprocal space, has emerged as a new design principle for materials that can host a wealth of novel properties. Interfaces and heterostructures with topological materials offer opportunities to control and manipulate their electronic states and associated phenomena, for example, via electric field effect, strain, or symmetry breaking. In this presentation, we will discuss recent progress in the growth of thin films of the three-dimensional Dirac semimetal Cd3As2 by molecular beam epitaxy. We show that high-mobility, epitaxial Cd3As2 films can be grown and discuss some of the phenomena that can be observed, such as an unusually large negative longitudinal magnetoresistance under parallel electric and magnetic fields. These heterostructures allow for experimental tests of theoretically predicted transitions between topological states by manipulating parameters, such as confinement and film strain. For example, as the film thickness is reduced, a band gap opens in the bulk Dirac electronic states and we observe a quantum Hall effect that is associated with surface states. In the second half of the talk will discuss a different type of topological phenomenon, namely the realization and control of non-trivial spin textures in oxide heterostructures and how these affect the electrical transport properties, such as the Hall effect.

Tuesday, February 20 • 4 pm | Tech L211

Reception • 5 pm | Willens Wing Atrium

Susanne Stemmer is Professor of Materials at the University of California, Santa Barbara. She did her doctoral work at the Max-Planck Institute for Metals Research in Stuttgart (Germany) and received her degree from the University of Stuttgart in 1995. Following postdoctoral positions, she moved to Rice University, where she was Assistant Professor from 1999 to 2002. In 2002, she joined the University of California, Santa Barbara. Her research interests are in the development of scanning transmission electron microscopy techniques, oxide molecular beam epitaxy, functional and strongly correlated oxide heterostructures, and topological materials. She has authored or co-authored more than 240 publications. Honors include election to Fellow of the American Ceramic Society, Fellow of the American Physical Society, Fellow of the Materials Research Society, Fellow of the Microscopy Society of America, and a Vannevar Bush Faculty Fellowship of the Department of Defense.



Morris E. Fine, Walter P. Murphy and Technological Institute Professor Emeritus of Materials Science and Engineering, was a pioneer in teaching the unifying concepts underlying all classes of materials: metals, ceramics, polymers, biomaterials, and electronic materials. He was a co-founder of Northwestern's Department of Materials Science, the first of its kind in the world. Fine received his PhD in physical metallurgy from the University of Minnesota in 1943. After working on the Manhattan Project in Chicago and Los Alamos, he worked for Bell Labs until 1954, when he came to Northwestern. Fine advised 70 Ph.D. students and many M.S. students, and provided advice and guidance to many generations of MSE students at-large, always sharing his enthusiasm for new ideas. His research spanned a broad range of topics, from physical chemistry to mechanical behavior, and included studies on metals and alloys, ceramics, and composite materials. He published over 300 papers and received numerous awards. His belief in research that is both fundamental and useful and collaboration with the local steel industry led to successful application of his Cu-strengthened "NuCu" structural steels. More than 500 tons of this steel were used for a bridge in Lake Villa, Illinois, that opened in 2006. In 2009, the Department of Materials Science and Engineering created the Morris E. Fine Lecture to celebrate his life and contributions.

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