2016-2017 IMA Public Lectures

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Inverse Problems and Harry Potter's Cloak

Gunther Uhlmann,
University of Washington

Inverse problems arise in all fields of science and technology, where information is obtained about an object from a set of observed measurements. Taking human vision as an example, our brains construct a detailed, 3-D map from measurements of scattered light that reach our retinas. Thus, solving inverse problems can reveal what is hidden. But can objects be made invisible? Fascination with this subject includes Greek mythology and science fiction like Star Trek and Harry Potter. This lecture will explore several inverse problems and then describe a simple and powerful proposal for achieving invisibility, the so-called transformation optics, and other progress that has been made in the last decade.

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EIGHTH ANNUAL ARNOLD FAMILY LECTURE

Magic with Group Testing

Anna Gilbert,
University of Michigan

In the 1940s, several economists in the U.S. Public Health Service devised a cost-saving method known as pooling designs to examine groups of drafted soldiers for disease in a single test. These designs—and the more general problem of testing large populations of items—became known as combinatorial group testing. This lecture will demonstrate the usefulness of group testing with a simple magic trick, describe some modern applications of group testing in genetics, and then illustrate several group testing designs that come from error-correcting codes, which are used to transmit information so that a decoding algorithm can detect and correct errors.

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Gunther Uhlmann holds a Ph.D. in mathematics from the Massachusetts Institute of Technology and is the Walker Family Endowed Professor of Mathematics at the University of Washington. He is also an adjunct professor in the department of applied mathematics. Uhlmann has received several honors and awards, including the Sloan Research, Guggenheim, and Simons Fellowships, being elected as a fellow of the AAAS, SIAM, and AMS, and presented with the Bôcher Memorial Prize and the Kleinman Prize. His research interests include inverse problems and imaging, partial differential equations, microlocal analysis, and scattering theory.

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Anna Gilbert holds a Ph.D. in mathematics from Princeton University and is the Herman Goldstine Collegiate Professor of Mathematics at the University of Michigan. She also holds a joint appointment in the department of electrical and computer engineering. Her research interests include analysis, probability, discrete mathematics, and algorithms with a focus on randomized algorithms that have applications to harmonic analysis, signal and image processing, and massive datasets. Gilbert has received several awards, including a Sloan Research Fellowship, an NSF Career Award, and the Kleinman Prize.

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