

WHAT LENSES DO AND DON'T DO

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This talk addresses some fundamental aspects of lenses, some of which are not widely known or seem rarely to be explicitly formulated. Some of these properties are related directly to laws of physics, but they are expressed in terms of waves or rays in ways that may not be obvious. Other properties follow from the rotational symmetry of lenses. Part of the message is that, in thinking about lenses, it is often helpful to consider the imaging of an entire volume, rather than limiting considerations to images of points and planes. The lens can be thought of both in terms of its action on rays and upon its action on waves, and in some cases properties associated with rays can be understood in terms of waves and vice versa. Some simple proofs of important generalizations are given.

Douglas Goodman received a Ph.D. in Optics in 1979 from the University of Arizona Optical Sciences Center, where his advisor was Roland Shack. He then joined IBM Research in Yorktown Hts., New York. He was paid to leave IBM, in 1993, and he began work in the Polaroid Optical Engineering department. In 2002, he joined Corning Tropol, where he is a Senior Scientist. He is interested in education and in the organization of knowledge for more efficient learning and the power of demonstrations to arouse curiosity. He has been active in the Optical Society of America and SPIE, and is a fellow of both. He has taught a number of different full day and half day professional short courses. He wrote two book chapters "Survey of Optical Instruments," in *Geometrical and Instrumental Optics* and "Geometrical Optics," in *Handbook of Optics*, as well as various papers and talks, both invited and unwanted. He is obsessed with overhead projectors and their use in optics demonstrations. He has done numerous presentations in this manner and has written a book *Optics Demonstrations with the Overhead Projector*. He received the 2001 OSA Esther Hoffman Beller Award for outstanding contributions to optical science and engineering education. The areas in which he has worked include image formation, illumination, photolithography, phase-shifting masks, alignment, metrology, optical inspection, machine vision, microscopy, optical testing, laser ablation, focus sensing, laser print heads, optomechanics, optical systems engineering, and the theory of classical optics. He is not related to Joseph Goodman.