

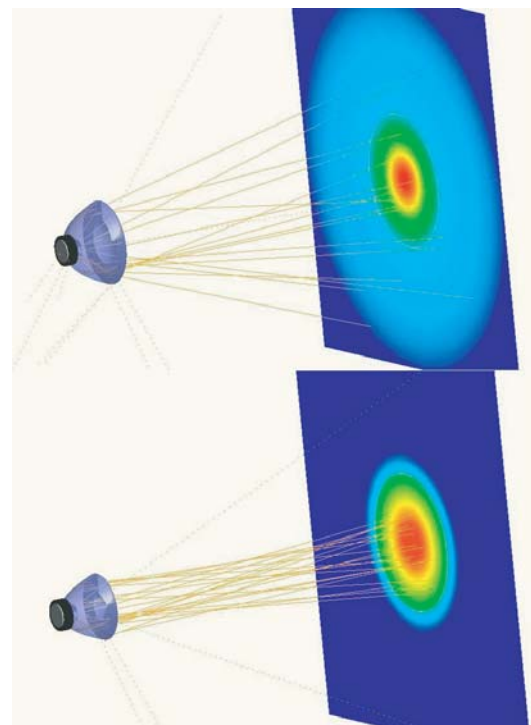
## Nonimaging Optics: From Design to Manufacture



**John Koshel**  
**College of Optical Sciences**  
**The University of Arizona**  
**and Photon Engineering**

BS and PhD Optics, Rochester  
Postdoc Colorado

A survey of nonimaging optics from a broad  
perspective: history, practice and future.



**10:00 am, Thursday, April 3rd, 2008**  
**Goergen 109, Fantone Auditorium**  
**Refreshments served**

# Nonimaging Optics: From Design to Manufacture

**John Koschel**

College of Optical Sciences/The University of Arizona and Photon Engineering

## **Abstract**

Nonimaging or illumination optics is concerned with the efficient transfer of light from the source to the target with a prescribed distribution of light. These criteria are fundamentally different than imaging optics, which has the metric of best imaging through reduction of spot size. I will first introduce the illumination field through its history, a discussion of the industry, and current research topics. Next, I present a discussion that takes nonimaging optics components from the initial design stage through optimization to tolerancing and fabrication. The fundamental design methods are based on the radiometric principles of étendue and skewness. These two factors, especially their invariance, provide a path to optimal design of the illumination system. Nonimaging reflectors and lightpipes will be used to illustrate these points. I will then introduce the complexities of nonimaging optic optimization through a few examples. Tolerancing and the ensuing manufacture of the optics is the final step in the process. This aspect of illumination optics has received little attention until recently. I will present methods based on experimental measurement of sources (e.g., LEDs) and ripple on injection-molded optics (e.g., lightpipes). These measurements are then included in later modeling to improve the acceptance rate of manufactured parts. I will end with a discussion of the future of nonimaging optics and the research I will be conducting.

## **Biography**

After graduating from The Institute of Optics with BS and PhD degrees, John held postdoctoral positions at the Univ. of Colorado and NIST. He briefly taught in the Department of Physics and Optical Engineering at Rose-Hulman Institute of Technology. Since he has worked for optical software companies in the areas of consulting and software development. He is currently an Adj. Asst. Prof. at the College of Optical Sciences/The Univ. of Arizona and the Principal Illumination Engineer at Photon Engineering. At both of these places he works in the field of illumination/nonimaging optics by conducting research, teaching, software development, and consulting. His current research areas are illumination system tolerancing and optimization, lit-appearance modeling, and étendue. He is active in both the OSA and SPIE, where he is the chair for a number of illumination engineering oriented conferences. He is the chair elect for OSA's Optics Design and Instrumentation Division and the past chair for IODC 2006. He is currently writing a number of books for the illumination field.