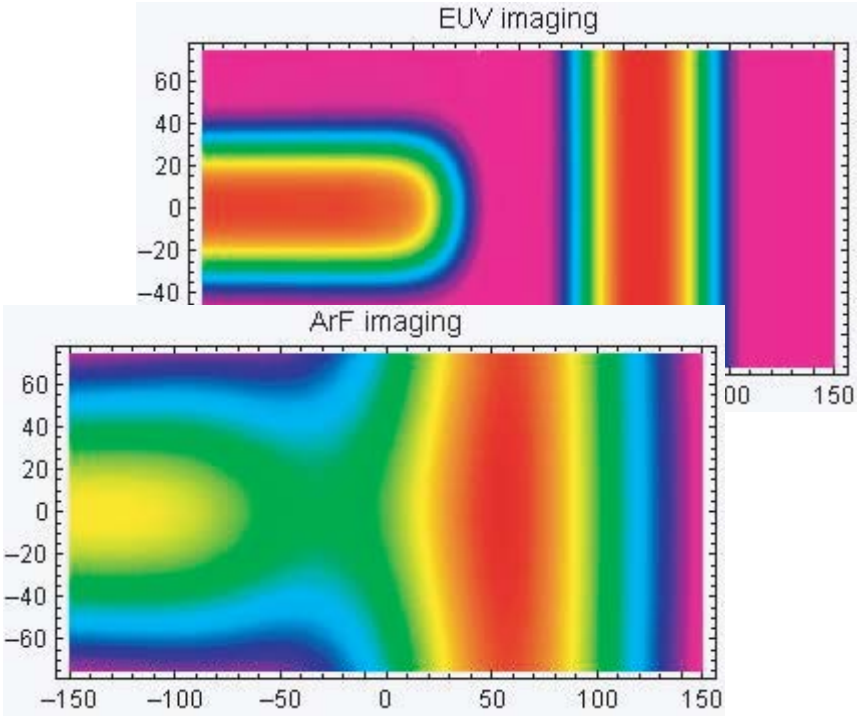
The Institute of OPTICS

Colloquium

UNIVERSITY of ROCHESTER

Optical Design for Microlithography

David Williamson
Nikon Research Corporation of North America



Projection optical designs and strategies are reviewed, ranging from Offner's 3-mirror and Dyson's 1-mirror monocentric designs, to modern reduction Dioptric and Catadioptric lenses with well over 20 elements.

3:00 pm, Monday, October 13, 2008
Sloan Auditorium, Goergen Building
Refreshments provided

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Abstract

The history of this field of projection lens design has been one of increases in NA from 0.1 to greater than 1.0, reductions in wavelength from 435 nm to 13 nm, and as-built wavefront aberrations from the classical Marechal “diffraction-limited” criterion of 70 milliwaves rms, to a few milliwaves. At the same time, image distortion on the wafer has been reduced to a few nm over a 26 mm, or greater, field diameter. These developments, often considered impossible before they were attempted, have allowed the progress of Moore’s Law since the early 1970’s, from chip feature sizes of 3000 nm, using 435 nm light, to the current nanotechnology realm below 50 nm, using 193 nm light.

Some historical projection optical designs and strategies are reviewed, ranging from Offner’s 3-mirror and Dyson’s 1-mirror monocentric designs, to modern reduction Dioptric and Catadioptric lenses with well over 20 elements. Future production systems expect to see a return to simpler Catoptric designs, but these have challenges of their own.

Biography

David Williamson entered the field of microlithographic lens design in 1985, at the Semiconductor Equipment division of Perkin Elmer. In 1990 this was sold to Silicon Valley Group. In 2001 he moved to Nikon Research Corporation of America, where he commutes between Tucson, Arizona and Malvern, UK. He has designed projection optics in the near, deep and extreme ultraviolet wavebands. He has also contributed to the development of alignment and illumination optics, as well as tolerancing and compensation methods that have pushed the state of the art in optical manufacturing technology.