Optical design of objectives for reducing photolithography

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Abstract: This paper reviews the technical solutions for reduction optical photolithography systems based on the principle of obtaining a scaled-down object image. Dioptric reduction system design trends are discussed and applied, technical solutions for building such systems are proposed. Genuine optical systems are offered which comply with the requirements mentioned above.

Introduction:

The projection photolithography in the general case can be performed by simultaneously transferring all topological layer elements to a plate. The common transfer technique for the reduction photolithography is the element-wise projection of separate fragments or the direct patterning in a photoresist layer by means of focused light beam, therefore a high aperture of objectives is the most essential condition of reduction photolithography. It can be accepted that in such a case only a small part of a template image is obtained, the full image can be obtained by scanning or moving the template and the plate synchronously, or by moving the objectives itself.

**Concept and possibility of use the microscope objective in reverse ray tracing**:

The basic concept of the reducing photolithography objectives optical design involves the application of methods for arranging microscope objectives with the reverse ray tracing (from an image toward an object) as per their dimensions and aberration properties.
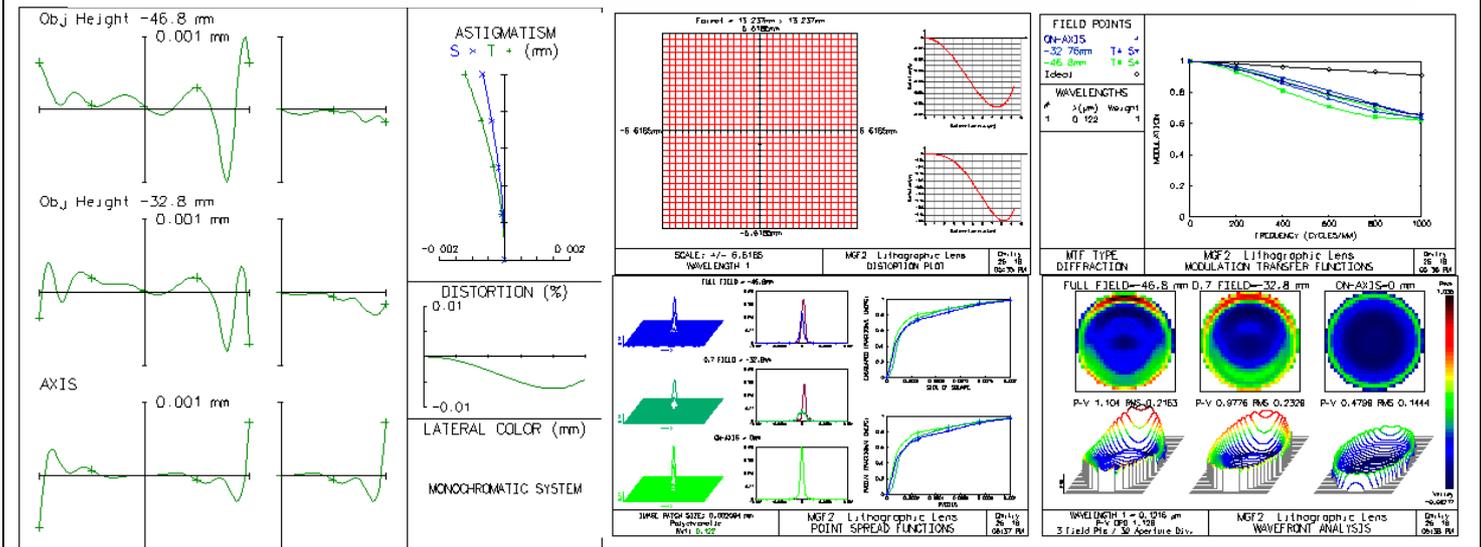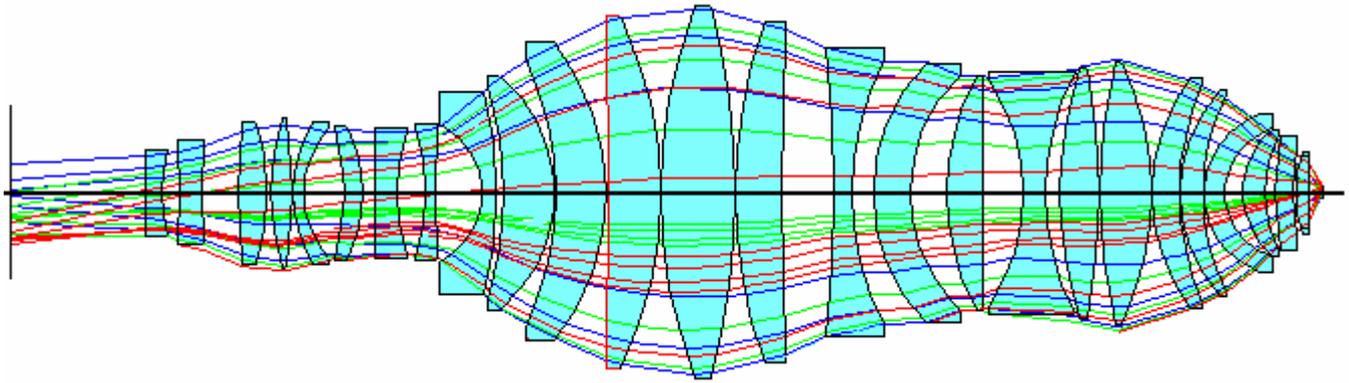

Layout and aberrations of Monochromat wave length 365 nm objective F'=2.0 mm NA'=0.9 for reducing photolithography:
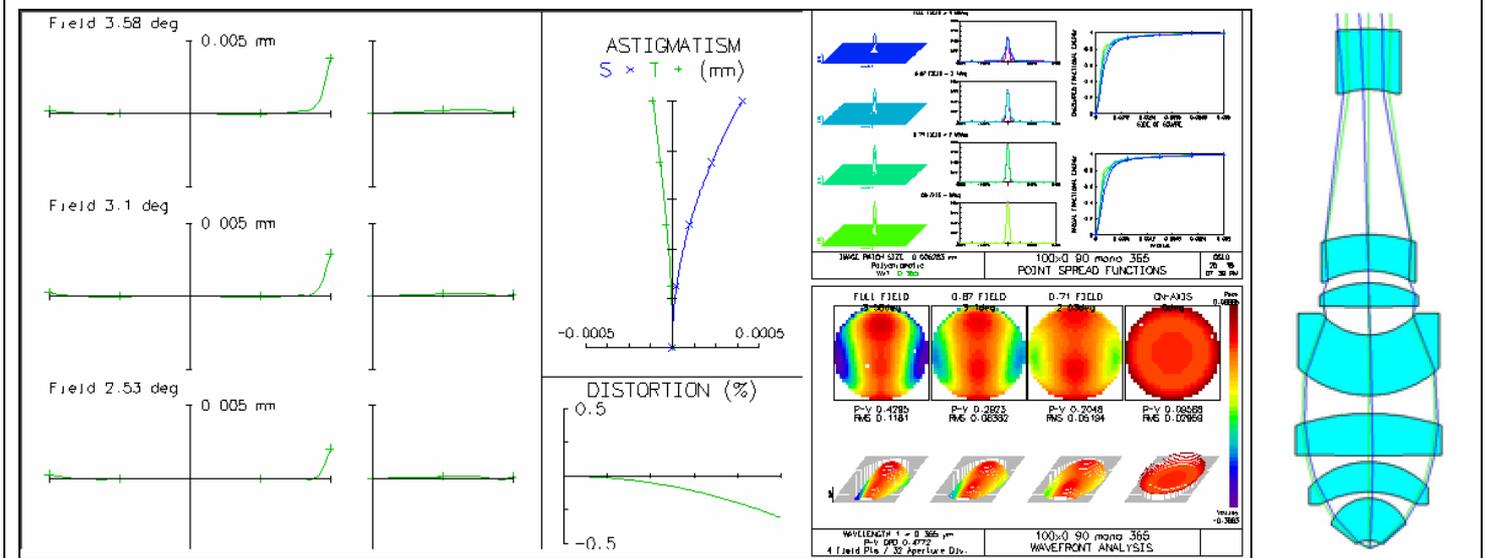
Layout and aberrations of Monochromat wave length 121.6 nm objective F'=10 mm NA'=0.9 for reducing photolithography:
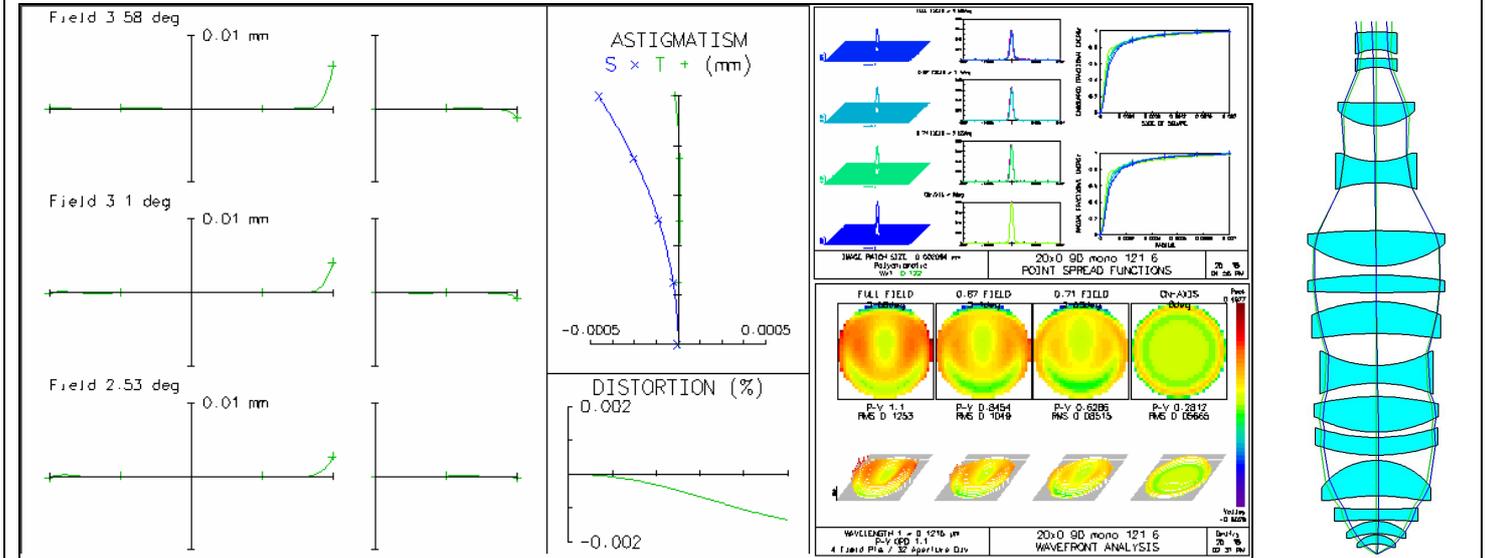
Layout and aberrations Monochromat wave length 121.6 nm objective V=-0.2^x NA'=0.9 for reducing photolithography:

Conclusion. This paper reflects the opinion of optical engineers who design optics according to the requirements to overall dimensions and aberration characteristics of the reduction photolithography systems. Considering that there are many such systems we offer the method and specific examples of designs made for some of them.