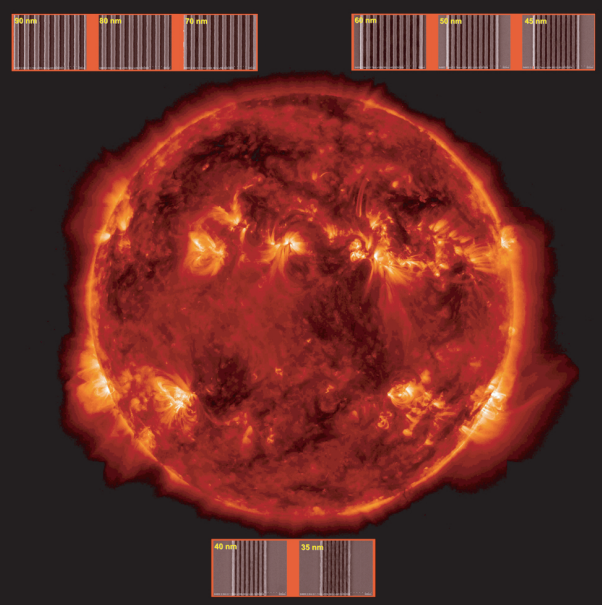
Eberhard Spiller

"Imaging in the EUV, Soft X-ray, and X-ray Region"

Eberhard Spiller spent most of his career at the IBM T.J. Watson Research Center in Yorktown Heights, NY, as a staff member. He retired from IBM as "IBM Emeritus" in 1993 and started Spiller X-ray Optics. His main activity now focuses on soft x-ray optics for applications in microscopy and lithography. He pioneered the applications of reflective mulitlayer coatings for synchrotron radiation and of normal incidence soft x-ray optics for astronomy. His extensive publication record includes a book and several book chapters on soft x-ray optics and applications.



X-ray imaging has not changed very much from Röntgen's first shadowgraphs. We still record mostly shadowgraphs, using absorption contrast with a resolution in the 0.1 mm range for nearly all medical x-ray pictures. Phase contrast imaging would enhance the contrast of x-ray pictures by many orders of magnitude, but has up to now only been used for microscopic objects. Atomic resolution around 1 Å was achieved in 1912 with x-ray diffraction, albeit only for the periodic structures of crystals. The capability to reconstruct crystals with larger and larger unit cells represents the main advance of the last decades. High-resolution imaging of non-periodic objects still remains a challenge. Multilayer mirror systems with diffraction-limited resolution have been fabricated for extreme ultraviolet (EUV) lithography for wavelengths around 135 Å. Zone plate microscopes are used for imaging biological objects and computer chips. The common feature of all imaging methods is to overcome the small scattering cross section of materials by adding contributions from multiple subelements either in the camera or in the object. The direct reconstruction of nonperiodic objects is presently a very active field helped by advances in fast computers and the availability of bright coherent x-ray sources. Challenges are radiation damage to the specimen and the large information content in an image.

3:00 p.m. • Wednesday, October 6, 2004
The APS Auditorium, Building 402
Argonne National Laboratory

APS Colloquium