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X-ray multilens interferometers based on Si refractive lenses

Content

The evolution of X-ray sources such as third generation synchrotrons and free electron lasers has led to a development and utilization of coherence-related techniques. The laser-like properties of such sources allow one to realize the paraxial schemes of interferometry techniques like Young double slit interferometer or a grating interferometer. The idea of these setups is based on creating of a set of secondary sources by narrow slits. This approach has some disadvantages associated with relatively large size of secondary sources, intensity losses and low resolution of an interference pattern as well as limitations in the use of interferometers in a hard X-ray region (>30 keV) where they become weakly absorbing.

A new approach to creating of small secondary sources is to utilize interferometers based on refractive optics [1]. Recently, we demonstrated bilens and multilens interferometers which under coherent illumination generate array of mutually coherent beams focused at some distance [2-3]. The size of the focal spots is restricted to the diffraction limit and can be less than tens of nanometers. These interferometers can be used in the wide X-ray energy range while maintaining high energy efficiency. The field of applications of the interferometers based on refractive optics is not limited only by a beam diagnostic and can be extended into a beam conditioning and beam-shaping areas. Moreover, such systems of lenses open up new opportunities for development of phase contrast imaging techniques.

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References

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