Waveoptical Investigations of X-Ray-Mirrors with Special Regard to Figure Errors and Roughness

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A diffraction limited but small focus point is crucial in modern x-ray diffraction techniques. The focus size of reflective x-ray optics is limited by its low numerical aperture – only in the regime of total reflection, reflectivity of a single surface is significant. Multilayer mirrors though allow a considerable reflectivity at larger angles of incidence and so a smaller spotsize. They can be considered as an artifical crystal.

In the multilayer laboratory at the ESRF, Grenoble, such ML mirrors can be taylored for specific purposes. In analytical models it was shown [1] that the "perfect" form of a total reflection mirror (elliptical shape) yields aberration in the case of multiple reflective surfaces. With a new wave-optical description and simulation, we want to understand the effects of volume diffraction in a ML mirror and optimize the layers' shapes. Furthermore, we want to study the influence of fabrication and figure errors/inaccuracies.

This work presents numerical investigations on figure errors and roughness, in the simple case of a total reflection mirror used at the coherence beamline P10 at Petra III [2]; furthermore we demonstrate a splitting-up of the focus due to the Goosh-Hänchen effect. Generalizations for multilayer mirrors are made [3].

Referenzen

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