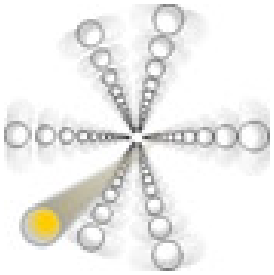

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High-reflectivity Laue lens made by curved crystals for high-resolution focusing of x and gamma rays

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At Sensor and Semiconductor Laboratory (Ferrara, Italy) we have undertaken a research and development plan to implement Si and Ge grooved CDP crystals onto the lens through several methods. An intriguing effect of anisotropy in crystal deformation is exploited to combine the high reflectivity of the CDP with the capability of focusing the radiation onto a very small focal spot. Quasi-mosaicity is used to fabricate self-standing curved crystals with two curvatures of different crystalline planes. Since the size of the focal spot of the photons diffracted by a crystal can be controlled by the quasi-mosaic (QM) curvature, QM crystals allow focusing with very high resolution, the signal-to-noise ratio being about an order of magnitude larger than that for mosaic crystals.
On the other hand, a stacking of equally curved crystal plates, aligned with each other with high accuracy is also proposed as an optical element for x- and gamma-ray focusing. In a Laue lens scheme, the stack should be positioned with the diffracting planes parallel to the major surface of the crystalline plate and perpendicular to the lens surface. Photons enter the stack nearly parallel to the diffracting planes, suffer diffraction and undergo focusing onto the detector. A stacking of grooved Si crystals has been characterized at ILL (Grenoble, France) and has proven to yield a well-defined focal spot under x-ray diffraction, highlighting sufficiently good alignment of the CDP in the stack. In this way the stack behaves as it were a single crystal from the point of view of diffraction by CDP. This technology opens up a viable way to build up optical components for x- or γ-ray diffraction without any size constraint, which may be useful in Laue lens application, where weight constraint is mandatory.

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