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Application of X-Ray Fluorescence Holography on the Superconductor Parent β -FeTe

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In the structure of the superconductor parent β -FeTe (P4/nmm, #129) excess iron atoms are necessary to stabilize the system, leading to the formula $\text{Fe}_{(1+y)}\text{Te}$. This structure is built up of iron and Te layers. Diffraction experiments indicate for the excess Fe atoms partial occupation of interstitial positions in the Te plane, resulting in octahedral coordination.

With the new technique of X-ray fluorescence holography (XFH) the atomic image can be recorded directly as the interference pattern of the Fe $K\alpha$ fluorescence. With applying this method on β -FeTe we try to determine the position of the excess iron atoms without the usage of a structural model.

Therefore, we have measured holograms of β -FeTe at two energies directly on the Fe K edge at the ESRF. Using the slight shift of the exact edge energy between the neutral excess Fe atoms and the charged Fe atoms of the regular Fe grid, we want to enhance the fluorescence emission of the two different Fe atoms selectively. From the holograms atomic images can be reconstructed using a sparse modeling algorithm.

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