Aspects of structured illumination TEM

In structured illumination transmission electron microscopy, the object is illuminated with an electron beam of randomly varying phases instead of a beam of constant phase; see Fig. 1. This makes it possible to attain superresolution, i.e. resolution beyond the Abbe-limit set by the objective aperture; see Fig. 2.

However, it remains unclear how the resolution of the result is influenced by partial coherence and what vertical resolution can be attained. The objective of this project is to find that out through extensive image simulations and subsequent reconstructions.

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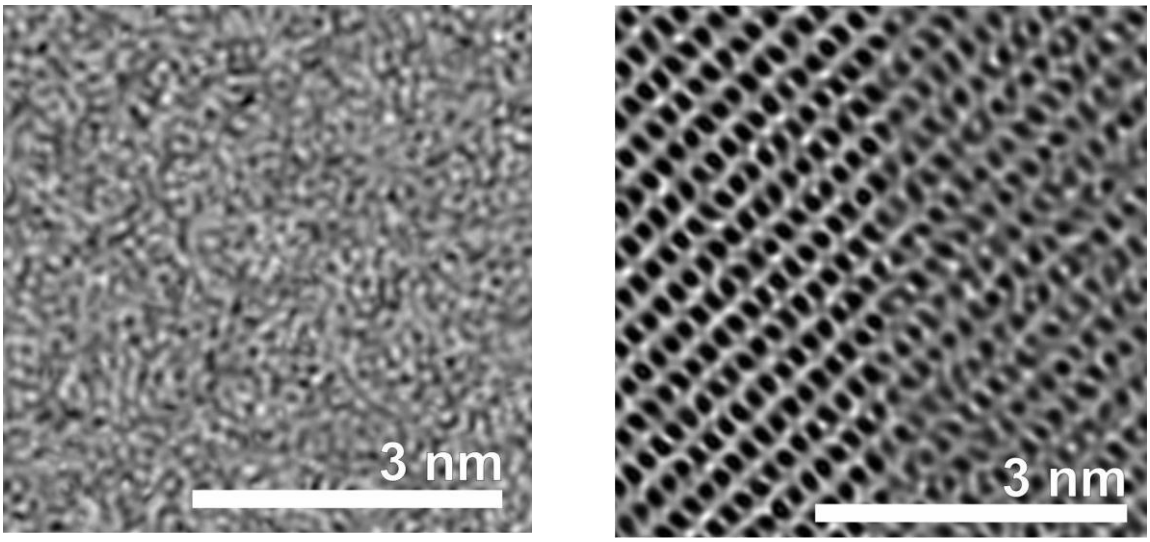

Fig. 1. *Left:* Intensity of the illumination with random phases. *Right*: Simulated TEM image of Si dumbbells with random-phase illumination. Note how, compared to Fig. 2, the dumbbells are *not* resolved.

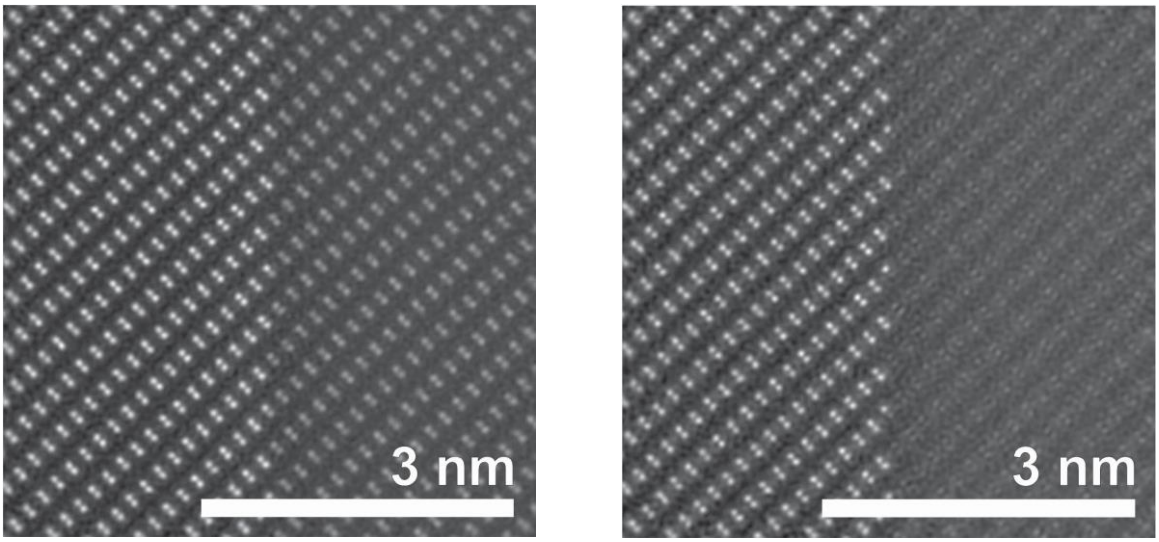

Fig. 2. *Left*: Reconstruction of the potential of Si in the middle of the sample. Note how the dumbbells are nicely resolved, despite being absent from the measurements in Fig. 1. *Right*: The reconstructed potential 2.5 nm lower, the right-hand side of the sample doesn't show atoms, thereby indicating there is *z*-sensitivity.