

# Caustic phenomena with electron waves

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Although caustic phenomena are well described in light optics [1], there are very few reports describing the generation and interpretation of caustics in the transmission electron microscope (TEM) [2,3]. Caustics that are formed in the TEM can be used both to understand aberrations of the electron wavefront and from a fundamental scientific perspective.

Here, we present a study of tunable caustics generated in the TEM using two electrically biased metallic needles. The needles are mounted opposite to each other in a TEM specimen holder that allows them to be moved with respect to each other. The caustics can be tuned by changing the bias voltage between the needles, their separation, relative orientation and defocus. We recorded caustic patterns in Lorentz mode (with the conventional objective lens of the TEM switched off). Off-axis electron holograms were also formed with the help of an electrostatic biprism located above the selected area aperture plane. Experimental caustic patterns were compared with simulations of their intensities and phase distributions.

## References

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