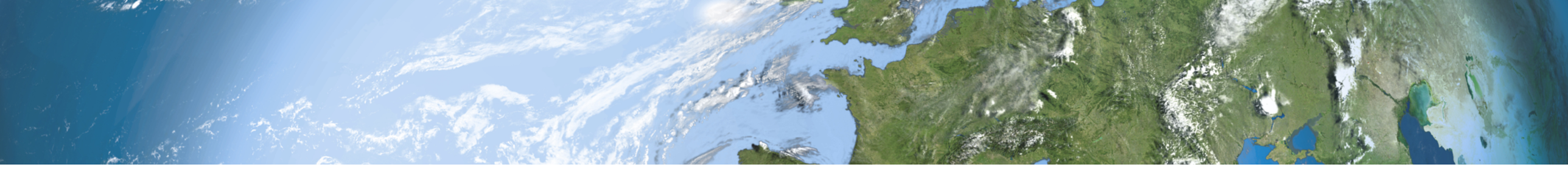
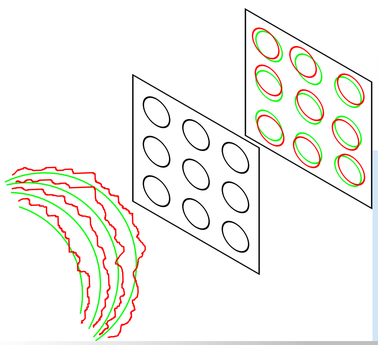


Towards Reconfigurable Wavefront Sensing Using a Spatial Light Modulator

Jan Hieronymus[1,*], Sven Augustin[1,2] and Heinz-Wilhelm Hübers[1,2]

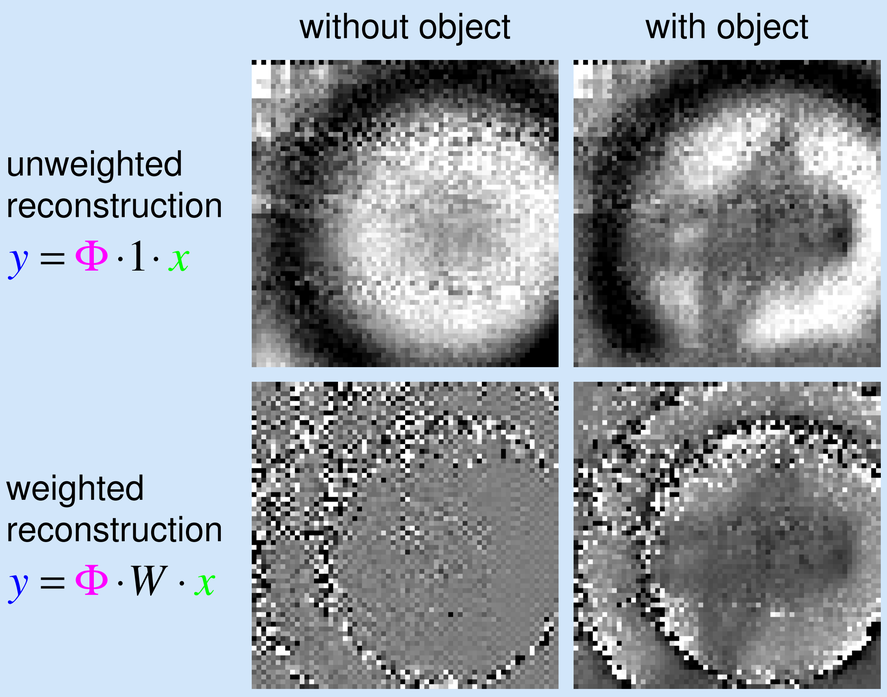
[1]German Aerospace Center (DLR), Institute of Optical Sensor Systems, Rutherfordstr. 2, 12489 Berlin, Germany
[2]Humboldt-Universität zu Berlin, Department of Physics, Newtonstr. 15, 12489 Berlin, Germany
*Jan.Hieronymus@DLR.de



Introduction

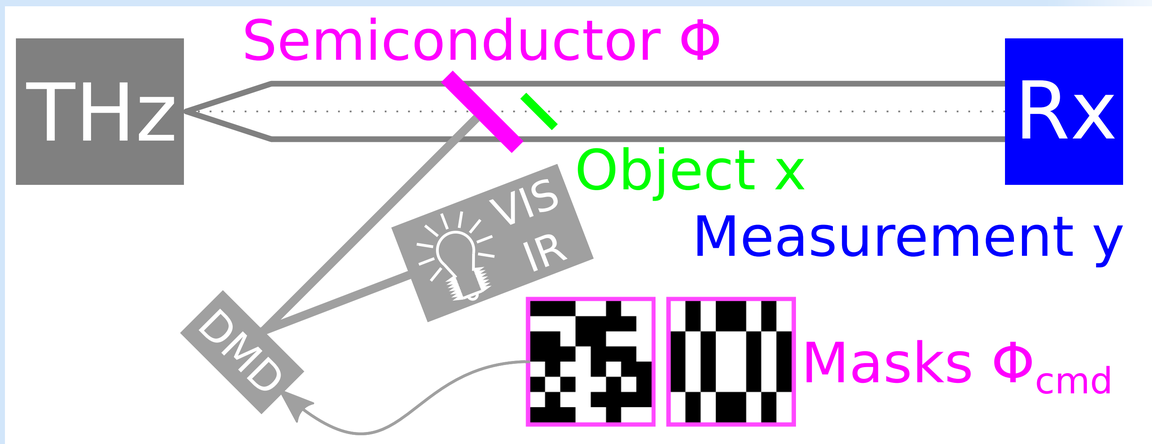
A 0.345 THz single pixel camera has been set up. Reconstructed images always contain circular artefacts, which depend on the geometry of the setup. Comparing the artefacts with Fresnel Zone Lenses suggests that they result from interference effects of the coherent radiation. In addition to imaging, the spatial light modulator can be configured to serve as a Hartmann mask for wave front sensing, as diffraction simulations indicate. An improvement employing Fresnel Zone Lenses instead of holes is expected.

Circular Imaging Artefacts



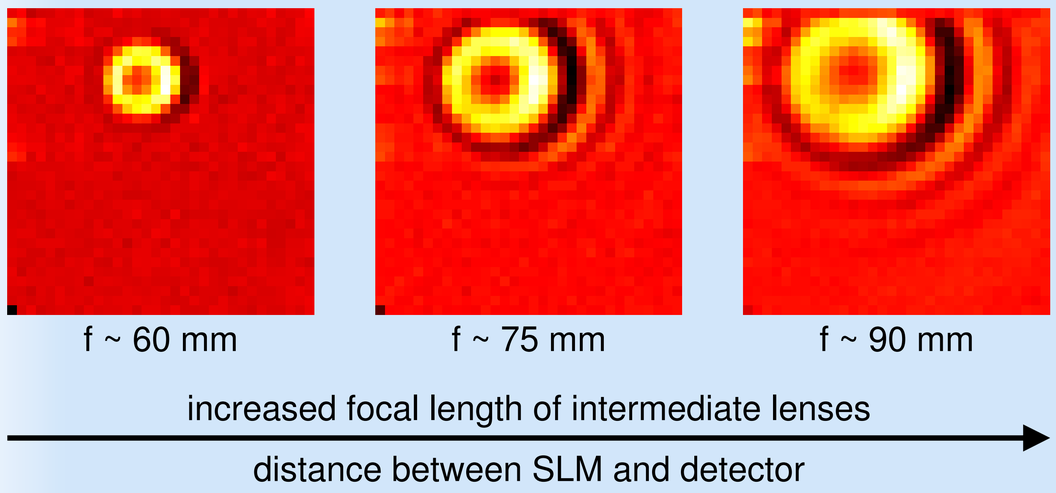
- Periodic ring structure around the imaged scene, limiting the field of view of the THz single pixel camera

Single Pixel Camera (SPC) Imaging Setup

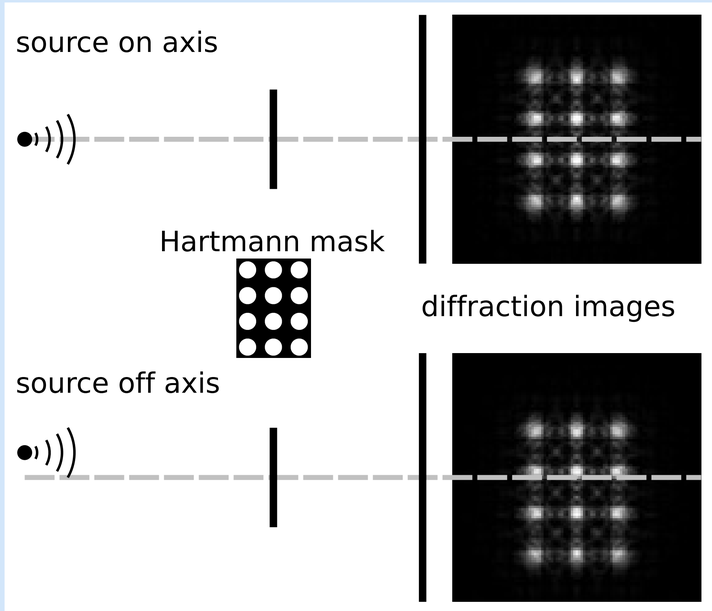


- 0.345 THz Electronic Source
- Heterodyne Receiver
- Spatial Light Modulator (SLM), illuminated Germanium
- Digital Micromirror Device (DMD)
- Image acquisition without mechanical scanning
- THz-SPC employing Compressed Sensing

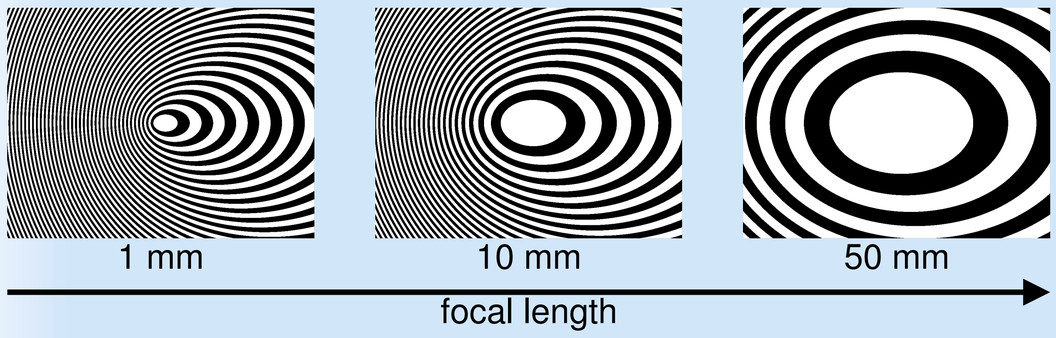
Analysis of Circular Imaging Artefacts



Hartmann Wave Front Sensing Setup

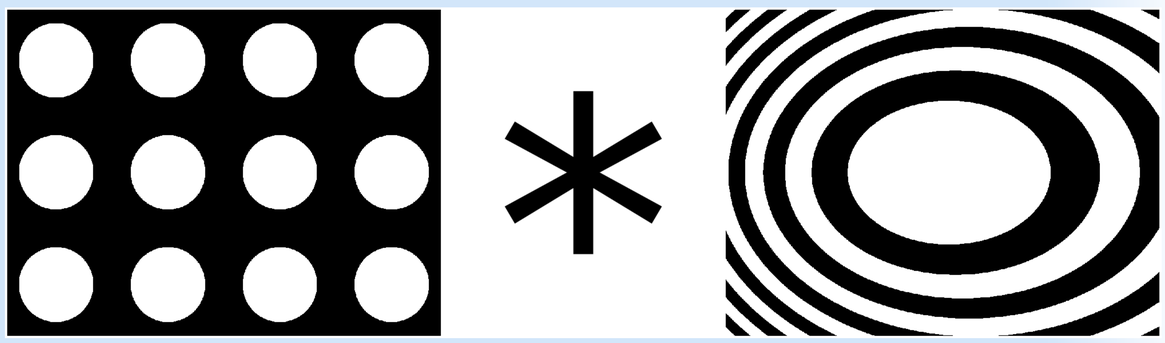


Theoretically calculated Fresnel Zone Lens (FZL)



- Asymmetric design for 45° tilted SLM

Outlook: FZL based Shack-Hartmann Setup



- Convolution of Hartmann mask and Fresnel Zone Lens

References and Acknowledgements

J.H. acknowledges support by the Helmholtz Research School on Security Technologies (HRSST).

This work has been supported by the project "Compressed Sensing for Terahertz Body Scanners" in the SPP 1798 (CoSIP) of the Deutsche Forschungsgemeinschaft (DFG).

Deutsches Zentrum für Luft- und Raumfahrt

Helmholtz Research School on Security Technologies

Humboldt-Universität zu Berlin