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Research or Master Thesis

RF

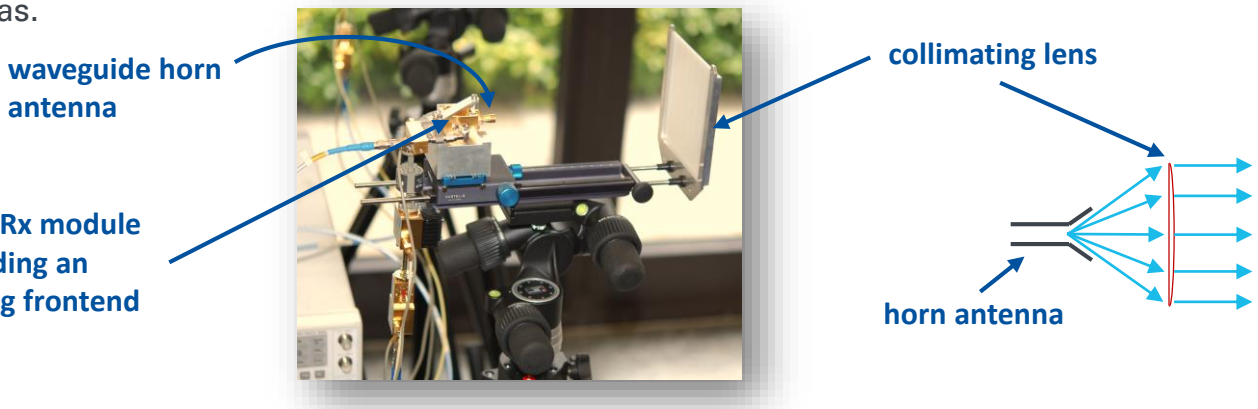
# Design and Fabrication of Collimating Lenses for Wireless THz Communication Links

## Motivation:

Future back-haul links operating at THz frequencies will be used in wireless communication technologies like 6G and beyond. The required ultra-high data rates in the range of 100 $Gbits^{-1}$ and beyond are enabled by the H-band (220 – 330 GHz) where large bandwidths are available. One major challenge in wireless THz communication is the increasing free-space path loss (FSPL) opposed to the achievable maximum output power considering transmit and receive front-ends using solid-state amplifiers. The limited gain of only a couple dBs for patch antennas on chip level as well as 15 to 25 dB for horn antennas on waveguide level prevent large transmission distances for THz wireless communications systems. To improve the directivity of the system larger antennas, for example Cassegrain antennas with huge reflector diameters, are used to achieve antenna gain in the range of 55 dBi. Major drawbacks are the physical dimensions, heavy weight as well as the elaborate handling. A more convenient way with slightly reduced antenna gain is to use collimating lenses instead. The fabrication of such lenses is possible using various materials , e.g. silicon or polymers, in conjunction with fabrication methods like milling or 3D-printing.

## Goals:

Design, fabrication and test of a collimating lens suitable for lab-based and outdoor experiments with wireless THz links using waveguide horn antennas and / or on-chip antennas.




## Tasks:

- Literature research and evaluation of existing approaches
- Design and simulation of a polymer-based collimating lens
- Fabrication of the developed lens using 3D-print technology
- Test and characterization of the fabricated lens