

Master's Thesis Task in the Program Nano Optoelectronics

Thema: Design and Realization of compact THz sources

Task:

In the terahertz (THz) range between 300 GHz and 4 THz, many novel applications are currently being developed: contactless material detection and characterization, ultrafast wireless data transmission of several Tbit/s, and detection of hidden objects in robotics and security applications. For these application fields, compact signal sources and detectors are needed that can efficiently provide high output power, detect with high sensitivity and low noise, and be produced in a compact, robust, and cost-effective manner.

We investigate THz components based on heterojunction bipolar transistors (HBT) and resonant tunneling diodes (RTD) in various projects. The devices and their fabrication are developed in the field. They are examined as THz sources and amplifiers, with and without antenna structures, concerning maximum oscillation frequency and output power. Subsequently, the components produced here are integrated into innovative arrays and encased, aiming at free-space combination and beam steering capability.

In this work, THz sources should be further developed and fabricated on-chip concerning maximum oscillation frequency and output power up to 750 GHz. This also includes characterization at a high-frequency measurement setup.

Thus, the work encompasses three areas:

- THz source design & layout (on-chip & with antenna structure)
- Technological implementation of the designed circuits
- High-frequency characterization regarding power and frequency