# Ultrafast THz photoconductivity in GaAs nanobars: charge carrier confinement and implications for nonlinear THz optics

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Nonlinear properties of semiconductor nanostructures due to charge carrier confinement are very promising for THz technology: our calculations show that the nonlinear THz response per charge carrier in conveniently designed structures largely exceeds intrinsic nonlinearities in bulk semiconductors and even those in graphene.[1] These theoretical findings stimulated our research of ultrafast charge-carrier dynamics in high-quality GaAs nanobars.

We used time-resolved THz and multi-THz spectroscopies to assess the ultrafast photoconductivity in an array of aligned GaAs nanobars (prepared by MBE growth and e-beam lithography) at 300 and 20 K. These experiments were complemented by time-resolved THz local-probe measurements (THz-SNOM) within a single nanobar and by quantum-based calculations of the THz conductivity of confined electrons.[2]

Our investigations reveal prominent effects of the band bending close to the nanobar surfaces on the picosecond charge carrier dynamics and on confinement of electrons. This talk will provide details both on the charge carrier dynamics and on perspectives of their nonlinear behavior.

## References

[1] J. Kuchařík and H. Němec, Phys. Rev. B **103**, 205426 (2021).

[2] V. Pushkarev et al., Adv. Funct. Mater. **32**, 2107403 (2022).