

Ultra-fast YBCO detectors for single-shot THz spectroscopy of Coherent Synchrotron Radiation

Summary

Coherent Synchrotron Radiation (CSR) in the THz frequency range generated by short electron bunches is a promising instrument for many applications such as spectroscopy and non-destructive imaging techniques [1]. The variation of temporal and spectral THz pulse shapes that is due to the so-called bursting phenomenon however requires a bunch-by-bunch resolution of the THz signal [2]. Therefore the use of ultra-fast and broadband THz detectors is essential.

A state-of-the-art detection system based on superconducting YBa₂Cu₃O_{7-x} (YBCO) thin-films offers picosecond response times [3]. Patterning to sub- μ m dimensions moreover ensures suitable detector sensitivity for the detection of single THz pulses [4]. In addition of picosecond response times and broadband readout the YBCO detection system offers zero-bias detection and electrical-field sensitivity [5].

By combining the well-established technology for broadband YBCO detectors with narrow-band THz filtering we aim at the single-shot spectroscopy of CSR. The approach that is currently under development consists of an on-chip 4-pixel detector array with integrated narrow-band antennas and simultaneous broadband readout of all four detectors [6]. First testing of a prototype of the single-shot THz spectrometer allowed for the simultaneous bunch-by-bunch observation of the bursting CSR signal at two different wavelengths.

References

- [1] M. Abo-Bakr, et al., Phys. Rev. Lett. 90, 094801 (2003)
- [2] S. Heifets, et al., Phys. Rev. ST Accel. Beams 5, 064401 (2002)
- [3] P. Thoma, et al., Appl. Phys. Lett. 101, 142601 (2014)
- [4] P. Thoma, et al., IEEE Trans. on Appl. Supercond. 23, 2400206 (2013)
- [5] J. Raasch, et al., IEEE Trans. on Appl. Supercond. 25, 2300106 (2015)
- [6] A. Schmid, et al., accepted to IEEE Trans. on Appl. Supercond.

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