Enabling nanoscopy with sub-cycle time resolution at TELBE

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Scattering-type scanning near-field optical microscopy (s-SNOM) operated with TELBE's narrowband undulator source (0.1-2.5 THz) offers unique opportunities in the so-far largely unexplored field of THz non-linear nanoimaging, as it combines tunable and spectrally bright THz pulses with wavelength-independent spatial resolution of the order of 20 nm. In this contribution, I will report on the recent development of a passive synchronization scheme, the so-called THz-slicing [1], which ultimately enabled near-field microscopy at TELBE. Exploiting the CEP-stability of this source, we present the first sub-cycle resolved nanoimaging and spectroscopy results at TELBE, as well as signatures of non-linear THz near-field response in a topological insulator sample. In addition, I review the current and future plans for s-SNOM at TELBE enabled by the sustained funding within the ErUM program of the Federal Ministry of Education and Research (BMBF).

References

[1] M. Chen et al. *Opt. Express* **30**, 26955-26966 (2022)