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Detection of short-pulse terahertz radiation with field-effect transistors

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During the last decade, field-effect-transistor-based terahertz detectors (TeraFETs) have been developed to the competitive technology which enables a variety of new applications in the THz frequency range [1]. Among the achieved state-of-the-art performance [2] TeraFETs can also exhibit a strong nonlinear response to intense THz radiation pulses [3]. We show that the character of nonlinearity can be tuned by gate-to-source voltage from super-linear to saturation. We support this statement by experimental findings on TeraFETs fabricated in CMOS and GaN MMIC technologies using two different systems: a free-electron laser with ~20 ps THz pulses and a few THz cycle emission derived from a femtosecond Ti:Sapphire laser excited photoconductive emitter. Furthermore, the existence of a superlinear response regime can be supported using large-signal circuit modeling of antenna-coupled devices. This phenomenon can be employed both for THz autocorrelation measurement and to study the build-up time of rectified signal [4].

[1] G. Valušis, et al. MDPI Sensors 21.12, 4092 (2021).
[2] E. Javadi, et al. MDPI Sensors 21.9 2909 (2021).
[3] K. Ikamas, I. Nevinskas, A. Krotkus, and A. Lisauskas, Sensors 18, 3735 (2018).
[4] A. Lisauskas et al., APL Photonics 3, 051705 (2018).

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