

Title: Sub-wavelength terahertz beam profiling of a THz source via an all-optical knife-edge technique

Author/Authors: Szeping Ho, Anna V. Mazhorova, Mostafa Shalaby, Marco Peccianti, Matteo Clerici, Alessia Pasquazi, Yavuz Öztürk, Jalil Ali, Roberto Morandotti

Abstract: Terahertz technologies recently emerged as outstanding candidates for a variety of applications in such sectors as security, biomedical, pharmaceutical, aero spatial, etc. Imaging the terahertz field, however, still remains a challenge, particularly when sub-wavelength resolutions are involved. Here we demonstrate an all-optical technique for the terahertz near-field imaging directly at the source plane. A thin layer (<100 nm-thickness) of photo carriers is induced on the surface of the terahertz generation crystal, which acts as an all-optical, virtual blade for terahertz near-field imaging via a knife-edge technique. Remarkably, and in spite of the fact that the proposed approach does not require any mechanical probe, such as tips or apertures, we are able to demonstrate the imaging of a terahertz source with deeply sub-wavelength features (<30  $\mu\text{m}$ ) directly in its emission plane.