

Terahertz light bullet-induced nonlinearity in a gold thin film

Mostafa Shalaby¹, Carlo Vicario¹, and Christoph P. Hauri^{1,2}

¹Paul Scherrer Institute, SwissFEL, 5232 Villigen PSI, Switzerland

²Ecole Polytechnique Federale de Lausanne, 1015 Lausanne, Switzerland

*most.shalaby@gmail.com; Carlo.Vicario@psi.ch; Christoph.hauri@psi.ch

The concept of metamaterials is of growing importance for manipulating THz pulse characteristics. In nonlinear science, metamaterials have been successfully used to locally enhance the THz field intensity [1], thus overcoming the technological challenge in intense generation. In such structures, local field intensities up to 2.6 GV/m have been demonstrated [2]. These structures are made mainly from gold. However, so far the linear response of gold has been taken for granted in the design and measurements interpretation of such structures. Here, using an intense THz bullet (3.3 GV/m) [3], we show that the dielectric constant of gold is changed under high THz field. We performed our experiment on a thin gold sheet in a THz pump-optical Kerr rotation probe in reflection.

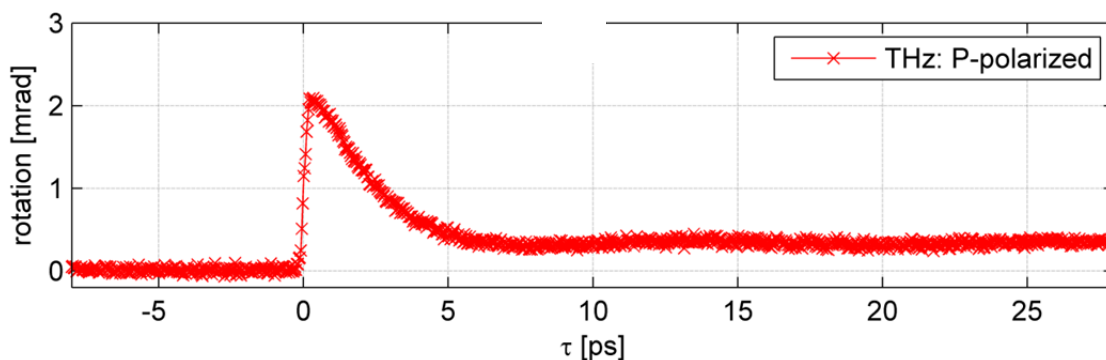


Fig. 1 The THz-induced polarization rotation on a collinear optical probe in a thin gold sheet.

References

[1] M. Liu *et al.*, *Nature* **487**, 345 (2012).

[2] M. Shalaby *et al.*, *Appl. Phys. Lett.* 99, 041110 (2011);

[3] M. Shalaby and Christoph P. Hauri, “Demonstration of a low frequency three-dimensional terahertz bullet with extreme brightness,” *Nat. Commun.* 6, 5976 (2015).