

# Coloured Digital Terahertz Holography

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Terahertz (THz) holography holds a unique position within the family of coherent imaging techniques [1]. In this work we have demonstrated multifrequency or “coloured” digital holography within the range of 1.39-4.25 THz.

Recorded holograms were reconstructed by using two- and four-step phase shifting (PS) technique, which removes the unwanted information and improves the quality of holographic images [2]. Phase values corresponding to the PS introduced by the object in the reference beam, allows deeper and more qualitative inspection of the investigated materials. Such technique provides more information about the low-absorbing objects, which can not be obtained using other imaging methods. This property was demonstrated by recording and reconstructing holograms of different amount of graphene layers.

Moreover, holographic images, obtained at three different frequencies – 1.39-, 2.52- and 3.11 THz were combined into one „coloured“ image, by employing a methodology analogous to the RGB colour model.

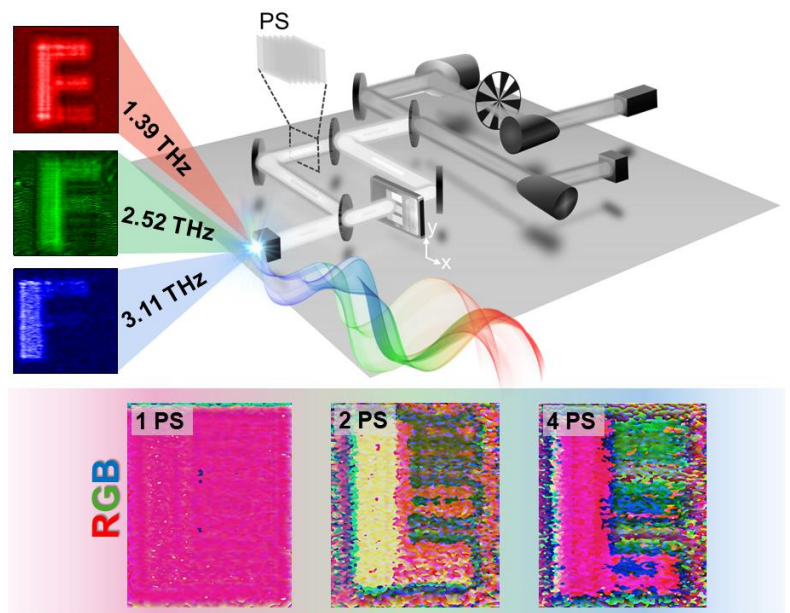


Fig. 1 Optical set-up for the recording of THz digital holograms at different frequencies. Insets on the left side represent imaging results at 1.39-, 2.52- and 3.11 THz frequencies. Bottom panel represents phase distributions of the combined holographic images obtained at three different frequencies, across all cases: without phase shift (1 PS) and using 2-step (2 PS) and 4-step (4 PS) phase shifting techniques.

## REFERENCES

- [1] M. S. Heimbeck and H. O. Everitt; *Advances in Optics and Photonics* **12** (2020) pp. 1-59.  
[2] A. Siemion et al., *AIP Advances* **11** (2021) 105212.