

Crack Detection in Pompeii wall paintings using Terahertz Imaging

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Abstract: Sub-THz imaging enables nondestructive analysis of frescoes, revealing internal structures without damaging sensitive artworks. Using a 300 GHz FMCW radar on a robotic arm, we acquired 3D scans of crack on a wall in Pompeii.

Cultural heritage conservation has greatly benefited from nondestructive testing techniques. In this context, imaging with sub-THz radiation due to a penetration of some mm, offers a promising candidate for the determination of the internal structure of ancient artworks that may be very sensitive to light, thermal and/or mechanical stimuli [1]. Among many proposed applications of THz imaging on cultural heritage, we are focusing on the ancient wall paintings (frescoes) and in particular on the delicate and sensitive frescoes found in the city of Pompeii (Italy).

A commercial THz scanner, an FMCW radar operating at 300 GHz (Terascan 300, Lytid SAS, France) mounted on a six-axis robotic arm, was used to acquire three-dimensional images over areas up to 50 mm×50 mm (figure 1). Measurements were performed in a room within the Villa of Diomedes in Pompeii.



Fig.1 | Experimental setup

As an example of structural discontinuity, we show a crack on the wall surface using the parameter map extracted from the fitting procedure (Figure 2). The plotted parameter is sensitive to the height variations, allowing us to investigate not only the surface morphology but also the internal evolution of the fracture.

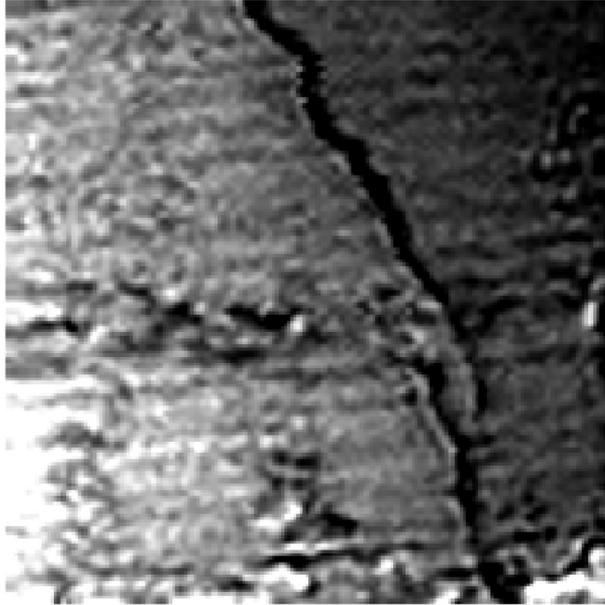


Fig.2 | THz picture of a crack

We thank IIT-CCHT and Pompei Archeological Park for support.

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References

[1] M. Bauer et al., 52nd European Microwave Conference (EuMC), pp. 808-811, 2022.