Sensing or imaging with THz radiation is undergoing strong development in the last years. Consequently, photonic structures to harness light are required. Light handling beyond conventional optical system capabilities is accomplished by metamaterials and with subwavelength patterned metal layers.

In this work new, easy ways of producing flexible metal-dielectric structured layers have been designed and demonstrated. Directionally solidified eutectics are used as substrates or templates to fabricate metallic corrugated structures and microholy metal arrays. Two features make the structures particularly relevant: the holes are filled with towering dielectric or polaritonic micropillars; and they can be transferred to polymer films, becoming flexible.

The optical properties of the metalized structures are governed by the properties of holey metal layers and by the size of the holes and the material filling them. Further, the towering micropillars couple the incident radiation to the structure. Enhanced transmittance bands from the near infrared to the THz have been observed. In particular, it is the polaritonic nature of the LiF micropillars, which fosters enhanced transmittance at around 40 μm through the absorption induced transparency mechanism (AIT). This is the first time that AIT could be experimentally demonstrated in the THz range.

It is expected that the proposed approach can be used to prepare structures adapted to particular needs, given that all the intervening processes are simple, scalable and inexpensive and there are various starting eutectic systems to choose as substrate.