Polarization-sensitive plasmonic terahertz interferometry using carbon nanotubes

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Abstract

Terahertz technology and science have been actively developing in recent years [1]. This is due to the wide avenue of possible applications of terahertz technologies in various fields: from security systems and medicine to space research and telecommunications [2]. Due to their unique electronic properties, carbon nanomaterials are promising for the creation of sensitive terahertz devices [3]. Here we report a helicity-sensitive terahertz photoelectric response of a carbon nanotube field effect transistor. The interference of plasma waves in a carbon nanotube (transistor channel) leads to the fact that the magnitude of the rectified photovoltage is different for radiation with circular polarization clockwise and anticlockwise. We found that such an interference contribution to the photoresponse is observed for systems of different dimensions with a different spectrum of individual particles. This opens up a lot of interesting possibilities for plasmonic terahertz interferometry.

REFERENCES

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FIGURES

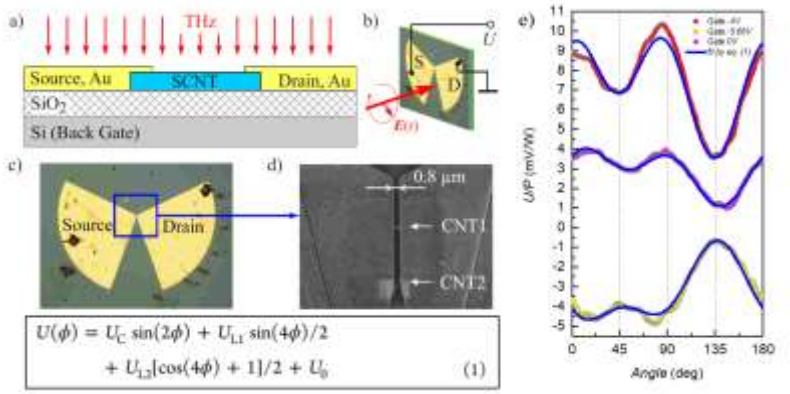

Figure 1: Device configuration and photoresponce. (a) Structures cross-section. (b) Experimental set-up sheme. (c) and (d) Optical and scanning electron microscopy (SEM) images illustrating the device layout with source and drain electrodes connected to sleeves of a bent bow-tie antenna. (e) Helicity dependence of the photovoltage U normalized by the laser radiation power. Different colors of the experimental points indicate different gate voltages. The X-axis represents the angle of rotation of the quarter-wave phase plate. Angle values 45 and 135 correspond to the right and left directions of rotation of the circular polarization, respectively. The blue curve is the fit calculated using formula (1) in the inset.