Plasmon-Polariton NanoOptics in Dirac Topological Semimetal

Salvatore Macis[1], **Annalisa D'Arco**[1], **Alessandro Molle**[2], **and Stefano Lupi**[1]

1. *Sapienza University of Rome, Department of Physics, Piazzale A. Moro 5, 00185 Rome, Italy*
2. *CNR-IMM, via C. Olivetti 2, 20164 Agrate Brianza (MB), Italy*

Abstract: Topological Surface Plasmon Polaritons (SPPs) exist at the interface between a topological metal and a dielectric. SPPs are topologically protected against scattering and present a peculiar optical response in the terahertz (THz) technological important spectral region. In this talk we present near and far-field optical data on micro and nano-arrays of $PtTe_2$-topological Dirac semimetal suggesting a promising path in nanophotonic devices for THz manipulation at the micro and nanoscale.

Surface Plasmon Polaritons (SPPs) are electromagnetic excitations existing at the interface between a metal and a dielectric. SPPs provide a promising path in nanophotonic devices for light manipulation at the micro and nanoscale with applications in optoelectronics, biomedicine, and energy harvesting. Recently, SPPs are extended to quantum topological materials [1,2], offering a promising frontier for THz radiation tuning by topologically-protected SPPs. In this talk, the THz optical response of platinum ditelluride ($PtTe_2$) Dirac topological semimetal films grown on Si substrates is investigated. SPPs generated on microscale ribbon arrays of $PtTe_2$ are detected both in the far-field and near-field regime, finding an excellent agreement among measurements, theoretical models, and electromagnetic simulation data [3]. The present findings indicate that $PtTe_2$ appears an ideal active layout for geometrically tunable SPPs thus inspiring a new fashion of optically tunable materials in the technologically demanding THz spectrum.

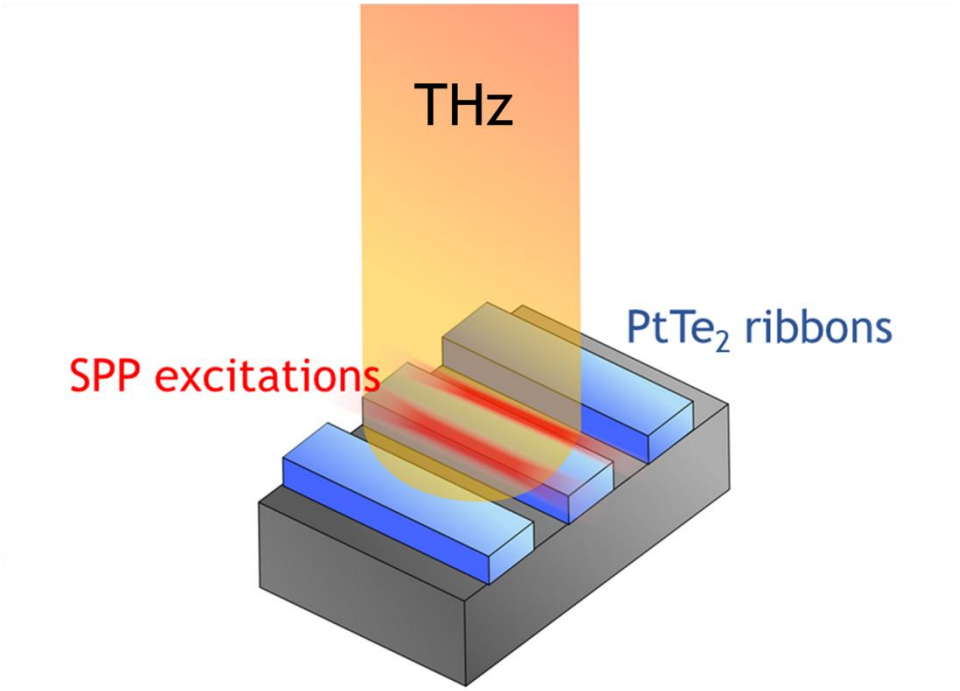

Fig. 1 Diagram of Surface Plasmon Polariton excitations (red stripes) generated by THz radiation on a $PtTe_2$ ribbon array microstructure.

References

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[3] S. Macis et al., *Terahertz and Infrared Plasmon Polaritons in PtTe2 Type-II Dirac Topological Semimetal,* Advanced Materials 36, 2400554 (2024);