Space-Time Metrology of Plasmons in Graphene

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Our team @ Columbia devised and deployed a novel nano-imaging technique: tera-Hertz (THz) space-time metrology [1]. We applied this nascent technique to investigations of the interacting electronic system of monolayer and Bernal bilayer graphene. Space-time metrology experiments allowed us to visualize the dynamics of THz plasmon polaritons in previously unattainable parameter space of (sub)pico-second time scales, 10-s of nano-meter length scales and THz frequencies. Space-time metrology provided direct readouts of the group velocity and lifetime of plasmon polariton that can be directly mapped onto the electronic spectral weight and the relaxation rate. Our experiments reveal a significant enhancement of the electronic spectral weight in Bernal graphene that is particularly prominent at in the vicinity of charge neutrality. We attribute this effect to electron-electron interactions in accord with earlier theoretical predictions [2]. Also, THz metrology uncovered unforeseen aspects of space-time duality in the dynamics of propagating plasmon polaritons [3].

References

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