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Gate tunable real-space plasmons in graphene revealed by infrared nano-imaging

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Z. Fei(1), A. S. Rodin(1), G. O. Andreev(1), W. Bao(2,3), A. S. McLeod(1), M. Wagner(1), L. M. Zhang(4), Zeng Zhao(3), G. Dominguez(6), M. Thiemens(5), M. M. Fogler(1), A. H. Castro-Neto(7), C. N. Lau(3), F. Keilmann(8), D. N. Basov(1)

(1) Department of Physics, University of California, San Diego
(2) Materials Research Science and Engineering Center, University of Maryland, College Park
(3) Department of Physics and Astronomy, University of California, Riverside
(4) Department of Physics, Boston University
(5) Department of Chemistry and Biochemistry, University of California, San Diego,
(6) Department of Physics, California State University, San Marcos
(7) Graphene Research Centre and Department of Physics, National University of Singapore
(8) Max Planck Institute of Quantum Optics and Center for Nanoscience

We report infrared nano-imaging of plasmonic fringe patterns in graphene at mid-infrared (IR) frequency range. By tuning the gate voltage, we were able to systematically change the carrier density of graphene while monitoring the evolution of these fringe patterns. We ascribe these fringe patterns to the interference of plasmon waves launched by the near-field probe with those reflected from the edges, which is further verified by our electrostatic simulation. Plasmon dissipation quantified through our modeling and analysis of the fringe patterns is linked to the exotic electrodynamics of graphene. Standard plasmonic figures of merits of our tunable graphene devices surpass that of common metal-based structures.

Primary author: FEI, Zhe (Department of Physics, University of California, San Diego)

Presenter: FEI, Zhe (Department of Physics, University of California, San Diego)

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