Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Tunable plasmonic resonators in Graphene with extreme light confinement[1] VICTOR BRAR, MIN SEOK JANG, JOSUE LOPEZ, HARRY ATWATER, Caltech, APPLIED PHYSICS -CALTECH TEAM — Graphene plasmons can display a number of interesting properties including small mode volumes, long lifetimes and energies that vary with the sheet charge density. In this work we investigate both experimentally and theoretically the behavior of graphene plasmons in the Mid-IR regime. We find that graphene monolayers that have been patterned with features from 30-100nm can support gate-tunable resonances across the Mid-IR, from 10-5um with charge densities up to 10^{12} e/cm^2. In our extreme limit, we observe that 30nm sized features cut in graphene can support plasmon resonances for light at 6um wavelengths, indicating mode volumes that are $\sim 10^6$ smaller than free space. We further show that these graphene plasmons can couple to phonon polaritons in the supporting dielectric substrate to create multiple new resonances at wavelengths near 10um. These results are analyzed in terms of both analytical calculations and finite element models.

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Date submitted: 29 Nov 2012 Electronic form version 1.4