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Atomically Localized Plasmon Enhancement in Monolayer Graphene JUAN CARLOS IDROBO, Oak Ridge National Laboratory, WU ZHOU, JAEKWANG LEE, Vanderbilt University, JAGJIT NANDA, Oak Ridge National Laboratory, SOKRATES T. PANTELIDES, Vanderbilt University, STEPHEN J. PENNYCOOK, Oak Ridge National Laboratory — Graphene has attracted significant attention due to its exceptional properties and very promising applications, including optoelectronics and nanoplasmonics. All localized plasmon resonances observed so far in materials have been limited to the sub-10 nanometer scale, with a reported record of $\lambda/40$, where λ is the wavelength of the related plasmon excitation. In this talk, using aberration-corrected scanning trasmission electron microscopy and total energy first-principles calculations, we show that single point defects can enhance the π and $\pi + \sigma$ plasmons of monolayer graphene at the atomic level. Our study shows that point defects in monolayer graphene represent a length scale smaller than $\lambda/200$, and suggest that the physical limit for the size of plasmonic and optoelectronic devices can be down to the single atom level. This research was supported by NSF grant No. DMR-0938330 (WZ, J-CI), DOE grant DE- F002-09ER46554 (STP), by the Shared Research Equipment (SHaRE) User Facility, Oak Ridge National Laboratory, which is sponsored by the Scientific User Facilities Division, Office of Basic Energy Sciences (J-CI), and by the Office of Basic Energy Sciences, Materials Sciences and Engineering Division, U.S. Department of Energy (JL, JN, SJP).

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