Characterization and Manipulation of Intervalley Scattering Induced by an Individual Monovacancy in Graphene

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Abstract (Century Gothic 11)

Intervalley scattering involves microscopic processes that electrons are scattered by atomic-scale defects on the nanoscale. Although central to our understanding of electronic properties of materials, direct characterization and manipulation of range and strength of the intervalley scattering induced by an individual atomic defect have so far been elusive. Using scanning tunneling microscope, we visualize and control the electronic properties especially the intervalley scattering from an individual monovacancy in graphene [1-3]. By directly imaging the affected range of monovacancy-induced intervalley scattering, we demonstrate that it is inversely proportional to the energy; i.e., it is proportional to the wavelength of massless Dirac fermions. A giant electron-hole asymmetry of the intervalley scattering is observed because the monovacancy is charged. By further charging the monovacancy, the bended electronic potential around the monovacancy softens the scattering potential, which, consequently, suppresses the intervalley scattering of the monovacancy [4].

References

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[2] Yu Zhang, et al. Phys. Rev. B (2020) 101, 155424.
[3] Yu Zhang, et al. Nano Lett. (2021) 21, 2526-2531.
[4] Yu Zhang, et al. Phys. Rev. Lett. (2022) 129, 096402.

Figures

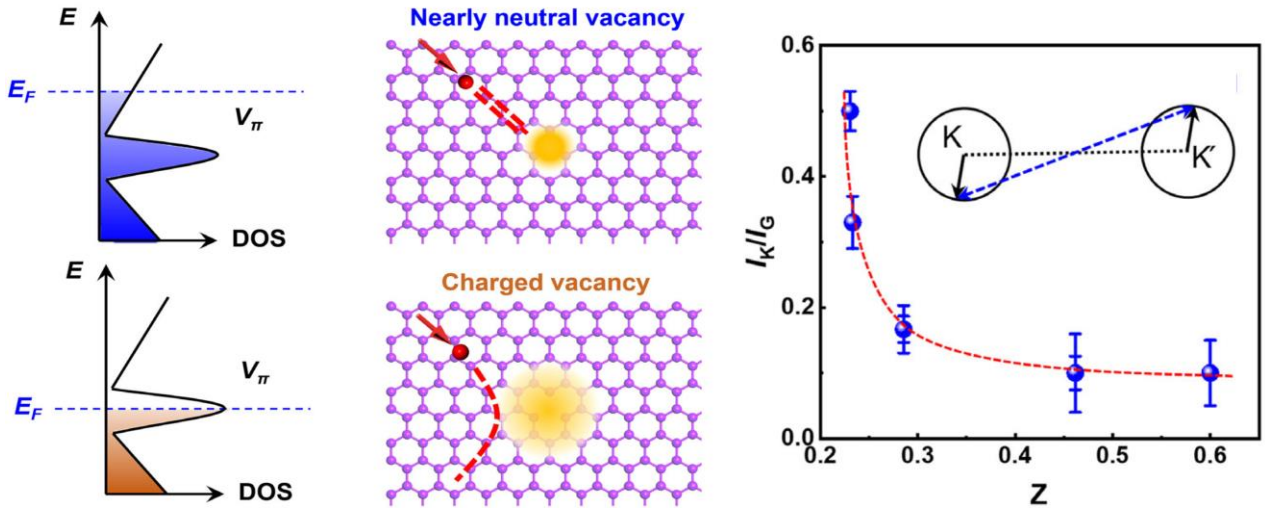

Figure 1: The suppression of the intervalley scattering induced by the charged monovacancy in graphene.