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Formation of unconventional standing waves at graphene edges CHANGWON PARK, Department of Physics and Astronomy, Seoul National University, HEEJUN YANG, Graphene Research Center, Samsung Advanced Institute of Technology, Samsung Electronics, JISOON IHM, Department of Physics and Astronomy, Seoul National University, GUNN KIM, Department of Physics and Graphene Research Institute, Sejong University — The electron scattering properties of graphene edge have been investigated by the interference images using the scanning tunneling microscopy (STM). A conventional metal with a terrace and a step can be modeled as a two-dimensional electron gas with a hard wall and this behavior was directly observed at the steps of Au(111) and Cu(111) surfaces by STM. Now, a question arises as to how two sublattices and two inequivalent valleys in graphene affect the scattering and the standing wave formation. We present how the contributions from two valleys vary in the scattering at different graphene edges. For the zigzag edge, only intravalley scattering is possible due to the different edge-direction crystal momentum of two valleys. For the armchair edge, in contrast, the wave is reflected mostly via intervalley scattering and as a result, an atomic-scale node-like pattern and beats in the standing wave are generated near the edge. When the incident angle is small, this intervalley scattering process is quite robust in the presence of defects so that we can still observe nodal patterns even for edges of relatively high defect densities.

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