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**Manipulation of Electron Beam Propagation by Hetero-Dimensional Graphene Junctions**<sup>1</sup> ZHENGFEEI WANG, FENG LIU, Department of Materials Science and Engineering, University of Utah — Manipulation of electron beam propagation in low-dimensional nanostructures is the fundamental process required for quantum information processing and quantum computation in the future. Recently, graphene has been proposed as a candidate system for splitting and focusing electron beam by applying an external field or potential. Here, we demonstrate theoretically a new mechanism for the energy-selective manipulation of electron beam by nanostructured hetero-dimensional graphene junctions (HDGJs) without external field. Electron beam splitting, collimation, and beam-guide can all be realized by designing HDGJs of different dimensionality, size and orientation. Importantly, these different functions can be combined together by pre-designed patterning of multiple HDGJ units in one graphene sheet, making it feasible for large-scale integration of graphene-based quantum devices. Furthermore, we show an effective method for mapping the electron beam propagation in graphene by scanning probe microscopy (SPM), as being done in two-dimensional electron gas (2DEG), which will be very useful for fundamental study of electron transport and quantum phenomena in graphene.

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