Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Electron optics lab-on-chip: Absorptive pinhole collimators for ballistic electrons in graphene ARTHUR W. BARNARD, ALEX HUGHES, Department of Physics, Stanford University, Stanford, California 94305, USA, AARON L. SHARPE, Department of Applied Physics, Stanford University, Stanford, California 94305, USA, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, 1-1 Namiki, Tsukuba 305-0044, Japan, DAVID GOLDHABER-GORDON, Department of Physics, Stanford University, Stanford, California 94305, USA — In the absence of scattering, electrons in graphene propagate as unperturbed waves, analogous to photons propagating in free space. However, these electrons possess distinctive interparticle interactions and unique refractive properties. These traits, in conjunction with the emerging capability of fabricating ultraclean graphene devices, have inspired widespread interest in on-chip electron optical systems built from graphene. While such systems have great promise, graphene's inherent chiral transport presents a unique challenge: chiral electrons cannot be readily confined by electrostatic gates. We overcome this fundamental challenge and present an attractively simple means of forming a collimated electron beam, an important building block for electron optical devices. Our collimators are formed by etched collinear slits combined with absorptive ohmic sidewalls between the slits. Here, we experimentally demonstrate collimated beams with full-width half maxima of 18 degrees or narrower. We use our collimators to form ballistic magnetometers as well as to directly observe Klein tunneling.

Arthur W. Barnard
Department of Physics, Stanford University, Stanford, California 94305, USA

Date submitted: 11 Nov 2016 Electronic form version 1.4