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Valley-symmetry-preserved transport in ballistic graphene layers with gate-defined carrier guiding MINSOO KIM, JI-HAE CHOI, SANG-HOON LEE, Department of Physics, Pohang University of Science and Technology, Korea, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, Japan, SEUNG-HOON JHI, HU-JONG LEE, Department of Physics, Pohang University of Science and Technology, Korea — Zigzag graphene nanoribbons are predicted to exhibit interesting electronic properties stemming from its Dirac band structure. However, to date, investigation of them is highly limited because of the defects and the roughness at the edges, which mix different valley properties of graphene. Here, we report the signature of conservation of valley symmetry in two types of quasi-1D ballistic graphene transport devices; one is a quantum point contact (QPC) and another is an Aharonov-Bohm (AB) interferometer. In measurements, charge carriers were confined in a potential well formed by the dual gates operation and the four-terminal magnetoconductance (MC) was measured with varying the carrier density, dc bias, and temperature. It exhibits the conductance quantization in steps of $\Delta G \quad = 4e^2/h$ starting from $G \quad = (2, 6), 10\times e^2/h$ in a constricted conducting channel of QPC-type devices. This behavior is similar to the one observed in zigzag graphene nanoribbons having edge localized channels. Our tight-binding calculation shows that quasi-1D charge flow on a graphene plane acts a zigzag-type nanoribbon, unless it is perfectly aligned along the armchair direction. In the AB interferometry, we observed h/e periodic modulation of MC and the zero-field conductance minimum with a negative MC background.

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