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Transport of Andreev pairs via quantum-Hall edge states in graphene GEON-HYOUNG PARK, MINSOO KIM, Dept. of Physics, Pohang Univ. of Science and Technology, Korea, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, Namiki, Tsukuba, Japan, HU-JONG LEE, Dept. of Physics, Pohang Univ. of Science and Technology, Korea
— Andreev reflection (AR), retro reflection of an incident electron as a hole and vice versa at a superconductor-normal metal interface, leads to the formation of an Andreev edge state (AES) that consists of a coherent pair of an electron and a hole in a strong magnetic field. The resulting incoming electrons and outgoing holes act as Andreev pairs, giving the zero-bias conductance enhancement along the AES. The coexistence of AR and quantum-Hall (QH) effect in semiconducting two-dimensional electron systems has been confirmed in two-terminal conductance measurement configurations where both bulk and longitudinal contributions are bound to be contained. Here we report signature of the AES formed in mono- and bi-layer graphene devices with a three-terminal measurement configuration. A graphene layer, encapsulated by hexagonal boron nitride crystals, was in proximity contact with a Nb electrode having a high upper critical magnetic field ($H_{c2}(0)$ ˜3.3 T). The high carrier mobility of our graphene layers allowed the formation of QH edge states in perpendicular magnetic fields as low as ˜1 T. The signature of AR was clearly visible in the bias spectroscopy as a conductance enhancement near zero-bias in both up and down stream of QH edge states corresponding to high filling factors.

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