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Gate-tunable Topological Pseudospin Transport in Bilayer Graphene MENGQIAO SUI, GUORUI CHEN, LIGUO MA, Department of Physics, Fudan University, WENYU SHAN, Department of Physics, Carnegie Mellon University, KENJI WATANABE, TAKASHI TANIGUCHI, Advanced Materials Laboratory, National Institute for Materials Science, XIAOFENG JIN, Department of Physics, Fudan University, WANG YAO, Department of Physics, University of Hong Kong, DI XIAO, Department of Physics, Carnegie Mellon University, YUANBO ZHANG, Department of Physics, Fudan University — Extra quantum degree of freedom, generally referred to as pseudospin, arises in condensed matter systems when electrons from two sublattices of a crystal form degenerate bands at Fermi level. Here we describe a pseudospin system based on the "which-layer" quantum degree of freedom in bilayer graphene that is fully tuned by top and bottom gates. We detect topological pseudospin current - a result of the broken symmetry induced by the top and bottom gate electric fields - in a nonlocal geometry. The nonlocal pseudospin transport persists up to room temperature owing to the large, tunable band gap in our bilayer graphene devices. The gate-tunable pseudospin quantum degree of freedom in bilayer graphene may lead to future pseudospin-based electronic applications.

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