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Spin transistor based on pure nonlocal Andreev reflection in EuO-graphene/superconductor/EuO-graphene nanostructure YEE SIN ANG, LAY KEE ANG, Singapore University of Technology and Design, CHAO ZHANG, University of Wollongong, ZHONGSHUI MA, Peking University — In graphene-magnetic-insulator hybrid structure such as graphene-Europium-oxide, proximity induced exchange interaction opens up a spin-dependent bandgap and spin splitting in the Dirac band. We show that such band topology allows pure crossed Andreev reflection to be generated exclusively without the parasitic local Andreev reflection and elastic cotunnelling over a wide range of bias and Fermi levels. We model the charge transport in an EuO-graphene/superconductor/EuO-graphene three-terminal device and found that the pure non-local conductance exhibits rapid on/off switching characteristic with a minimal subthreshold swing of $\sim$ 20 mV. Non-local conductance oscillation is observed when the Fermi levels in the superconducting lead is varied. The oscillatory behavior is directly related to the quasiparticle propagation in the superconducting lead and hence can be used as a tool to probe the subgap quasiparticle mode in superconducting graphene. The non-local current is 100% spin-polarized and is highly tunable in our proposed device. This opens up the possibility of highly tunable graphene-based spin transistor that operates purely in the non-local transport regime.

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