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Selective Equal Spin Andreev Reflections induced by Majorana Fermions¹

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The search for Majorana fermions has become an important subject in recent years. Zero-bias conductance peaks (ZBCPs) possibly induced by Majorana fermions have been reported in tunneling spectroscopy experiments. However, the origin of these ZBCPs is still under debate. In this talk, I would like to point out that Majorana fermions induce a special type of Andreev reflection processes called selective equal spin Andreev reflections (SESARs) [1]. For SESAR processes at a normal lead/topological superconductor interface, incoming electrons with certain spin polarization in the lead are reflected as counter-propagating holes with the same spin. The spin polarization direction of the electrons of this Andreev reflected channel is selected by the Majorana fermions. Moreover, electrons with opposite spin polarization are always reflected as electrons with unchanged spin. We show that the tunneling current from a ferromagnetic lead to a topological superconductor is strongly affected by the spin polarization direction of the lead due to SESARs. This property can be used to detect Majorana fermions in several candidate topological superconductors. The application of SESARs in generating giant spin currents in nodal topological superconductors will also be discussed.

[1] James J. He, T. K. Ng, Patrick A. Lee and K. T. Law, Phys. Rev. Lett. 112, 037001 (2014).

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