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Investigating long-range proximity effect in ferromagnetic Ni and Ni-Fe nanowires[1] MEENAKSHI SINGH, JAMES KALLY, WEIWEI ZHAO, MOSES CHAN, Pennsylvania State University — Singlet superconductors and ferromagnets entail incompatible spin orders severely limiting the range of the superconducting proximity effect in a ferromagnet ($\sim$ 1 nm). Contrary to this expectation, a very long-range proximity effect (LRPE, $\sim$ 600 nm) was found in crystalline ferromagnetic nanowires [Wang et al., Nat. Phys. 6, 389 (2010)]. Several mechanisms have been suggested to explain the LRPE, the most intriguing of which is the possibility of triplet superconductivity in the ferromagnet. We have conducted experiments to probe the mechanism of the LRPE. The LRPE persists in granular Ni nanowires, ruling out ballistic transport as a possible mechanism. Surface superconductivity in the oxide layer on the ferromagnetic nanowire is also ruled out based on critical current measurements. On changing the nature of the contacting electrodes, the range of the proximity effect is found to diminish significantly. This indicates that the nature of the interface between the superconductor and the ferromagnet is important as expected for triplet superconductivity. Tunneling measurements probing the superconducting gap in the ferromagnetic nanowire are underway.

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Meenakshi Singh
Pennsylvania State University

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