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Long-ranged supercurrents through half-metallic ferromagnetic CrO_2[1]

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In the last few years, the scenery in the physics of superconductor/ ferromagnet hybrids has changed considerably with the realization that spin triplets may be induced in the ferromagnet through the mechanism of odd-frequency pairing. Since the equal-spin component of the triplet is not susceptible to pair breaking by the exchange field, such correlations can sustain supercurrents over long lengths, in particular in fully spin polarized materials where only one spin band is available. In halfmetallic ferromagnetic CrO_2 for instance, where superconducting contacts were deposited on top of the ferromagnetic films, we observed the current to flow over 700 nm at 4.2 K [1]. Still, we also have fabricated devices where the supercurrent is absent, which indicates that the mechanism of triplet generation is not yet well in hand. The presence of non-homogeneous magnetization is important, and here the grain structure of the film appears to play a key role, as can be illustrated with data for films grown on different substrates (TiO_2 and Al_2O_3). Moreover, recent data will be presented which suggest that triplet generation can be improved by using an additional ferromagnetic layer in the contact area.

[1] M. S. Anwar, F. Czeschka, M. Hesselberth, M. Porcu, and J. Aarts, Phys. Rev. B **82**, 100501(R) (2010).

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