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Magnetic-field-induced superconductivity and damping of phase slips in Zn nanowires[1]

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We report an observation that Zn nanowires connected with Zn electrodes, after being driven resistive by the current, re-entered their superconducting state upon the application of a small magnetic field [1, 2]. A detailed experimental investigation was carried out, with variation of parameters such as magnetic field orientation, wire length, etc.. The results provide solid evidence that this is a nonequilibrium effect associated the coupling with the boundary electrodes. There are two characteristic length scales involved, approaching either of which weakens the effect. Most importantly, we demonstrated that it is more appropriate to consider the effect to be a stabilization of superconductivity that has been suppressed by an applied current. Although we do not present a formal theory to explain all of our results here, the effect is most likely a consequence of the dampening of phase fluctuations by quasiparticles which are created in the electrodes by small magnetic fields.

[1] Yu Chen, S. D. Snyder, and A. M. Goldman, Phys. Rev. Lett. 103, 127002(2009).
[2] Yu Chen, Yen-Hsiang Lin, S. D. Snyder, and A. M. Goldman, Phys. Rev. B 83, 054505(2011)

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