Majorana Fermions and Proximity Effect in Nanowires with Interactions and Disorder

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In this talk I will present recent results on single and double semiconducting nanowires with proximity gap and Rashba spin-orbit interaction predicted to host Majorana fermions. In re-examining the proximity effect we discovered that there is a large bandshift of the wire in the strong coupling regime which 'metallizes' the semiconductor, rendering topological phases and thus Majorana fermions rather improbable [1]. Some implications for recent experiments on Al-shell nanowires will be discussed. I will also discuss double Rashba-nanowires and crossed Andreev pairing [2] jn the presence of electron-electron interactions and disorder [3].

[1] C. Reeg, D. Loss, and J. Klinovaja, PRB 96, 125426 (2017); PRB 97, 165425 (2018); Beilstein J. Nanotechn. 9, 1263 (2018).

[2] J. Klinovaja and D. Loss, PRB 90, 045118 (2014); C. Schrade, M. Thakurathi, C. Reeg, S. Hoffman, J. Klinovaja, and D. Loss, PRB 96, 035306 (2017).

[3] M. Thakurathi, P. Simon, I. Mandal, J. Klinovaja, and D. Loss, PRB 97, 045415 (2018).