Minimal quantum dot based Kitaev chain with only local superconducting proximity effect

William Samuelson
Viktor Svensson, Martin Leijnse

Division of Solid State Physics and NanoLund, Lund University, Lund, Sweden
william.samuelson@ftf.lth.se

The possibility to engineer a Kitaev chain in quantum dots coupled via superconductors has recently emerged as a promising path toward topological superconductivity and possibly nonabelian physics [1,2]. In this talk, I will discuss how some of the main experimental hurdles on this path can be avoided by using only local proximity effect on each quantum dot in a geometry resembling a two-dot version of the proposal in Ref. [3]. There is no need for narrow superconducting couplers, additional Andreev bound states, or spatially varying magnetic fields; it suffices with spin-orbit interaction and a constant magnetic field, in combination with control of the superconducting phase to tune the relative strengths of elastic cotunneling and an effective crossed-Andreev-reflection-like process generated by higher-order tunneling. We use a realistic spinful, interacting model and show that high-quality Majorana bound states can be generated already in a double quantum dot [4].

References

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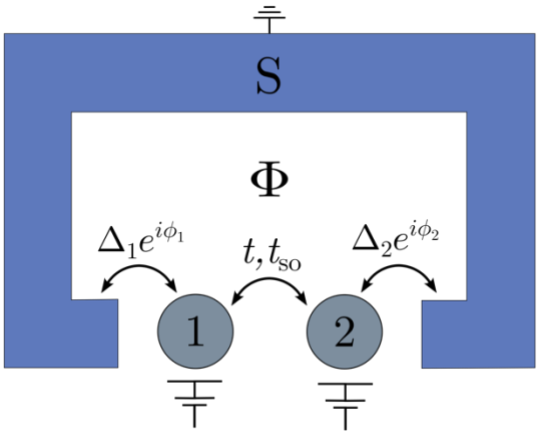

Figure 1 Setup consisting of two coupled quantum dots (1,2) with superconductivity induced by local tunneling to a bulk superconductor (S). Tuning the magnetic flux Φ drives the system to a Majorana sweet spot.