Majorana bound states in monoatomic Fe-nanowires on superconducting Pb

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Motivated by their potential use as topological qubits, Majorana bound states (MBS) have attracted an utmost interest. Theoretical calculations predict their occurrence in the combination of quasi-one-dimensional nanowire systems onto s-wave superconductors.

Here, we measure the spatial and electronic characteristics of topological, superconducting chains of iron atoms on Pb(110) to investigate the wave function and the localization length as fingerprint for MBSs [1]. After first observations by scanning tunneling microscopy (STM) [2,3], we demonstrate by combining STM and atomic force microscopy (AFM) at low temperature (< 5 K) that the Fe chains are mono-atomic, structured in a linear fashion, and exhibit zero-bias conductance peaks at their ends [4]. This can be interpreted as signature for a Majorana bound state [5].

From these observations, we strongly support the idea of using MBSs in Fe chains on superconducting Pb as qubits for quantum computing devices.

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