

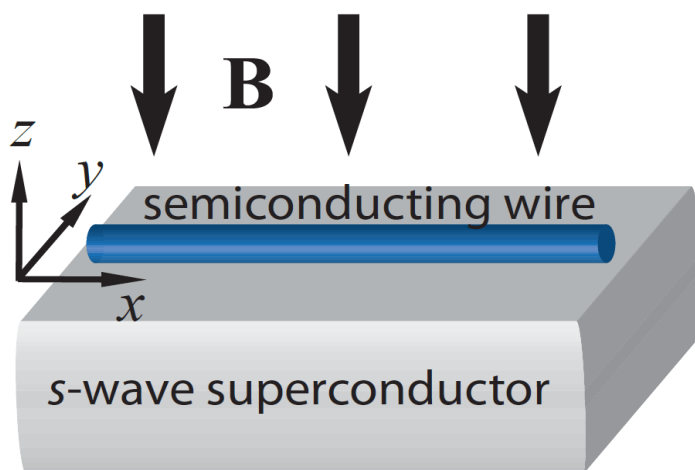


Physikalisches Kolloquium
06.02.2012, 17 Uhr c.t.

Hörsaal E

Making and manipulating Majorana fermions for topological quantum computation

Prof. Dr. Felix v. Oppen
*Dahlem Center for Complex Quantum Systems,
Freie Universität Berlin*



Proposed platform for realizing Majorana fermions, non-Abelian quantum statistics, and ultimately topological quantum computation.

Known theoretically for decades, Majorana fermions have never been observed as fundamental particles. But there is growing excitement among condensed matter physicists that Majorana fermions could be observed as quasiparticles in the solid state. This excitement is fueled by their remarkable properties: They are their own antiparticle and obey an exotic (and yet unobserved) form of quantum statistics called non-Abelian statistics. These properties make Majorana

fermions the simplest candidate for realizing topological quantum information processing which could go a long way towards alleviating the problem of decoherence in conventional quantum computation.

Among the systems predicted to support Majorana fermions are exotic fractional quantum Hall states as well as hybrid structures of topological insulators, semimetals, or semiconductors with conventional superconductors. Realizations based on semiconductor quantum wires in proximity to conventional superconductors are perhaps particularly promising since they allow for relatively detailed scenarios of how to manipulate Majorana fermions. After an extensive introduction to the field, this talk will focus on this proposal to realize Majorana fermions.