# Majorana Physics in Hybrid Superconductor-semiconductor nanowires

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Majorana Zero Modes (MZMs) have attracted attention in recent years due to fundamental interest in their predicted non-Abelian exchange statistics and their applications in topological quantum computation. The leading platform for realizing MZMs is the hybrid semiconductor nanowire-superconductor system, in which signatures of Majorana modes were first measured as a zero bias conductance peak in tunnelling spectroscopy experiments in 2012 [1]. Advances in material science [2,3] have since lead to strongly improved experimental results [4], culminating in the experimental realization of the theoretically predicted conductance quantization of the zero bias state [5]. However, despite significant progress, a definitive conclusion on the nature of this state has not been reached, and alternative explanations are being debated to this day.

In this talk, we present the state-of-the-art in Majorana nanowire experiments. We discuss the hybridization of superconductor and semiconductor materials which is crucial for the creation of MZMs, and how it is affected by external magnetic [6] and electric fields [7]. Finally, we give an overview of several alternative explanations for the observed zero bias conductance peak, in particular a scenario involving smooth parameter variations in space [8,9].

**References**

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