Semiconductor nanowires as a versatile platform for quantum electronic devices

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Over the last ten years, the use of semiconductor nanowires as building blocks for quantum devices has been extensively investigated. Owing to the many possible material combinations allowed in nanowire structures, a variety of quantum functionalities could be explored. After a broad overview, I will concentrate on small-band-gap III-V semiconductor nanowires. These types of nanowires have allowed access to a new research domain at the boundary between superconducting electronics and spintronics. In this domain, innovative device concepts have been explored such as electrically-tunable SQUIDs [1], sources of spin-entangled electrons [2–4], or recently proposed devices based on Majorana-fermion quasiparticles [5–7]. The operating principles of these hybrid devices rest ultimately on the magnetic properties of their elementary sub-gap excitations, also known as Andreev levels. I will present the results of a recent experiment addressing the spin properties of such Andreev levels [8]. This experiment was carried out on hybrid superconductor-semiconductor devices fabricated from InAs/InP core/shell nanowires.

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