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ABSTRACT

Topologically Protected Quantum Computation: About the Hardware

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The platform devised by the Microsoft consortium for the emergence of Majorana Zero Modes (MZMs), i.e., non-abelian anyons, which could be possibly fused or braided for realizing topologically protected quantum computation, is based on engineered mesoscopic InAs wires proximitized with a strip of superconducting aluminum, a technology previously developed by the Delft team. Presently, this hardware has raised questions since some of the Delft papers have been retracted.
The alternative hardware, which we propose, relies on massively parallel, high aspect ratio, spontaneously self-organized epitaxial nanoribbons (NRs) proximitized by a standard s-wave superconductor [1,2]. These highly perfect NRs are atom-thin pentasilicene nanoribbons (SiNRs) [2,3]. They could host distant MZMs at their extremities allowing for the creation of highly stable qubits preserved against external disturbances and environmental noise, thence, protected from decoherence.
Clearly, the self-assembly of these defect-free SiNRs could be a distinct advantage over presently engineered semiconductor mesoscopic wires or atom-by-atom constructed atomic lines.

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