# Emerging Majorana materials: towards topological quantum computing

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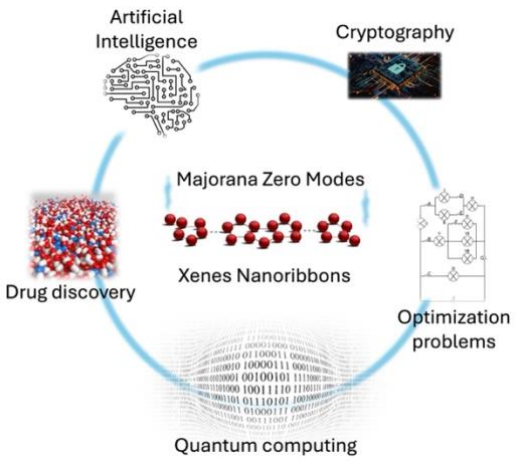
The development of robust quantum computing (i.e. with high coherence time qubits) and reliable ('error-proof') necessarily involves engineering new systems (such as topological qubits, etc.) with unique quantum properties. The pioneering work of Ettore Majorana on Majorana fermions (which are their own antiparticles) and of Alexei Kitaev to generate Majorana excitations or Majorana zero modes (MZMs) in a finite linear chain has inspired (since around 2010) research in condensed matter physics and materials science to create new qubit platforms. MZMs are exotic quasiparticles (anyons) that can interact with ordinary particles only under specific conditions. Therefore, they are very promising candidates for topologically protected qubits, storing quantum information in a non-local way, and could eventually enable the practical realisation of quantum logic gates, by exploiting their non-abelian statistics.

We can therefore expect a true revolution in many fields by tackling challenges previously considered insurmountable for conventional computers, exploiting the entanglement of quantum data to enable, among other things, massively parallel computing, access to data by its content, etc.

As the opposite figure shows, potential applications in cryptography, pharmacology, the solution of optimisation problems, artificial intelligence and much more could follow.




**The aim of this mini-colloquium is to bring together condensed matter physicists interested in this subject, in order to generate new, creative and fruitful ideas.**