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# Crossover from Ising to Rashba superconductivity in epitaxial $Bi_2Se_3$/monolayer $NbSe_2$ heterostructures

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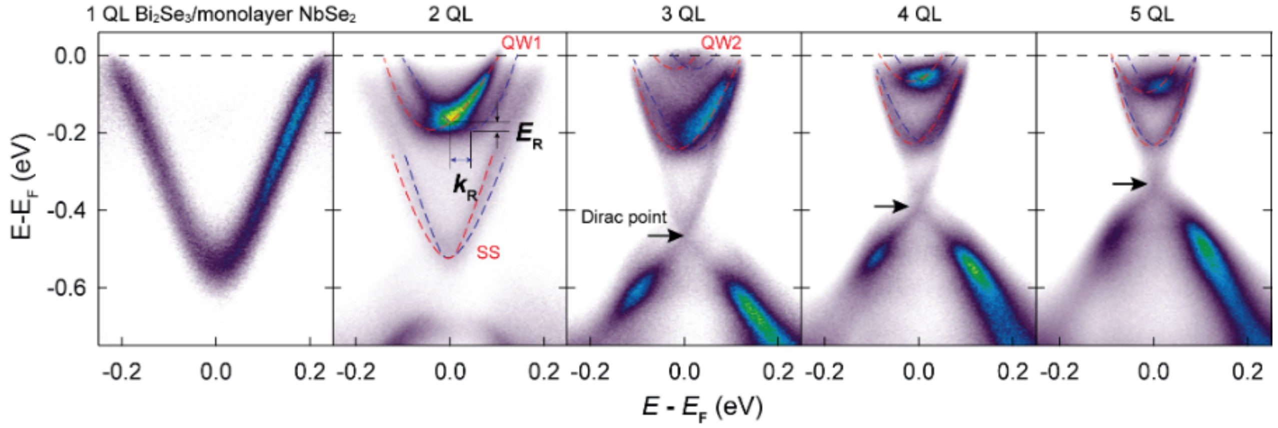
An IRG team developed a synthesis approach to combine two materials with distinct properties: monolayer Ising superconductor $NbSe_2$ and topological insulator $Bi_2Se_3$. This heterostructure enables the exploration of a unique form of superconductivity known as topological superconductivity, which is predicted to be foundational to the development of topological quantum computation.

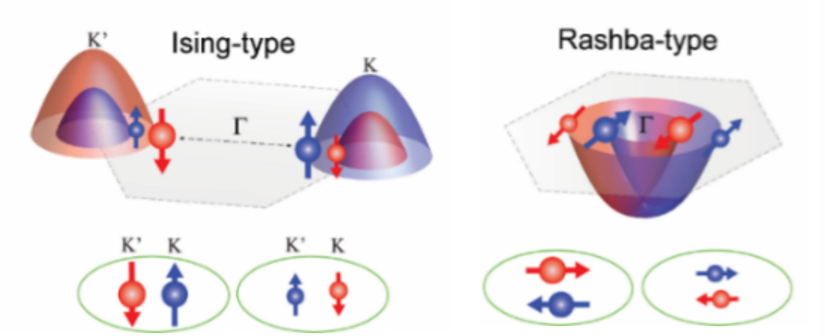
The team used molecular beam epitaxy, the deposition of atoms onto surfaces in ultrahigh vacuum conditions, to grow superconducting $Bi_2Se_3$/monolayer $NbSe_2$ heterostructures  with different $Bi_2Se_3$ thicknesses. Gapless Dirac surface states and Rashba-type bulk bands were both observed. The emergence of these features coincides with a suppression of the in-plane upper critical magnetic field. This is a signature of a crossover from Ising to Rashba superconducting pairing.

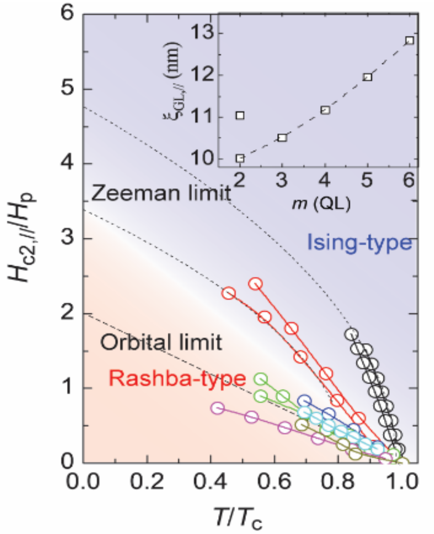
The establishment of molecular beam epitaxy growth of both Ising-type superconductor and topological insulator films will advance the exploration of robust topological superconductivity.

Yi et al, *Nature Materials* **21**,1366 (2022)

ARPES band maps of $Bi_2Se_3$/monolayer $NbSe_2$ heterostructures




Rashba type conduction bands and spin-nondegenerate Dirac surface states greatly suppress the in-plane upper critical magnetic field.