

NOVEMBER 2021



RESEARCH STUDYING THE ELECTRONICS OF THE FUTURE WITH QUANTUM GAS

Research published in the October edition of the journal Nature Physics sheds light on some quantum mechanisms at the basis of

spintronics, a sector dedicated to developing high-performance, low-consumption electronic devices. The study was conducted as part of a collaboration between the National Institute of Optics of the CNR, the Department of Physics of the University of Trento, and the Trento Institute for Fundamental and Application Physics, the TIFPA of INFN, as part of the Quantum at Trento (Q@TN) initiative. It provides new information on the magnetic orientation induced in a material as a result of aligning the spin of its electrons.

To achieve this result, the researchers cooled a gas of sodium atoms to temperatures close to absolute zero and, through the use of laser and microwave beams, manipulated the atoms in an extremely precise manner in order to obtain a particular quantum state able to mimic the interface between two different magnetic materials. This made it possible to identify a new type of magnetic wave that propagates within a cloud of atoms without friction, destroying the interface from which they were generated. This observation paves the way for future research into simulating magnetic materials in never observed before conditions, which are useful for understanding spintronics frontier phenomena.

Thanks to the universality of these mechanisms, which extend beyond the world of magnetic materials, this result also represents a first step towards the simulation of phenomena that are usually studied in subnuclear physics and astrophysics.