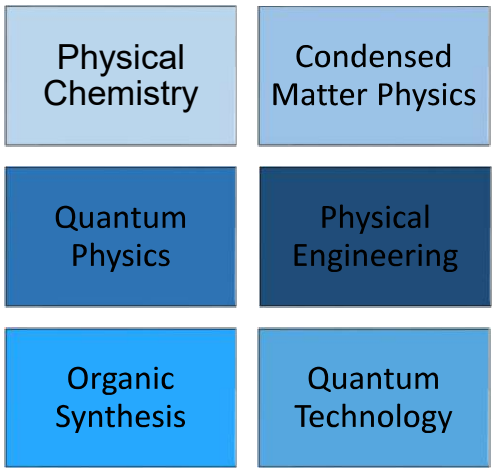
THE SPRING PROJECT

The SPRING project combines recent scientific breakthroughs from the six European consortium members to fabricate custom-crafted magnetic graphene nanostructures and test their potential as basic elements in quantum spintronic devices. The targeted long-term vision is the development of an all-graphene – environmentally friendly – platform where we aim to use spins for transporting, storing, and processing information.

The EU-funded H2020 project SPRING grants us to develop new graphene-based magnetic components that can contribute to the creation of faster and environmentally friendly electronic devices. The coordination institute of our international research project is CIC nanoGUNE (ES) in partnership with IBM (CH), University of Santiago de Compostela (ES), Technical University of Delft (NL) and University of Oxford (UK), and Donostia International Physics Center (ES).

AREAS OF RESEARCH

An added value of SPRING is the multidisciplinary character of the collaborative research approach, including the following thematic scientific areas:



Furthermore, partners in complementary sectors provide a rich and ideal environment for accessing to all stages of scientific development.

SPIN RESEARCH IN GRAPHENE

Spin is a fundamental property of some subatomic particles. Although it has not classical equivalent to describe it, spin can be understood in a loose way as the rotation of a fundamental particle of matter around itself- Every electron in any material carries both a charge and a spin, the latter playing a key role in magnetism. Therefore, spin is the ideal property of matter to expand the performance of current charge based nanoelectronics into a class of faster and more power-efficient components, being this the basis for the emerging technology called *quantum spintronics*. The SPRING project will investigate the fundamental laws for creating and detecting spins in graphene; this is to read and write spins and using them to transmit information.

While magnetism is usually associated with spins of electrons in d or f states, π electrons in graphene can also give rise to magnetism, the so-called π-paramagnetism. This form of unconventional magnetism emerges spontaneously as radical states in open-shell graphene structures. Graphene π-paramagnetism is more delocalized, mobile, and isotropic than spins in d-orbitals of transition metals, all very attractive properties for spintronics. Importantly, it can be electrically addressable. SPRING aims to develop concepts, tools, and methods for producing open-shell graphene nanostructures with a designed shape for emergent π-magnetization. Our aim is to demonstrate that these materials can become potential platforms for quantum spintronic devices.