OUR VISION & OBJECTIVES

The aspiration that is driving us through our project is the creation of a novel generation of graphene nano systems behaving as paramagnetic materials and the verification and validation of their potential in future technology. Furthermore, SPRING envisions to explore control of dynamical nuclear spin polarization in graphene-based nanostructures by electrical currents in three-terminal devices and lay the groundwork for a long-lived nuclear-spin classical or quantum memory.

To accomplish this goal, SPRING is structured along three main research lines:

- On-surface synthesis strategies will be utilized to create ***atomically precise open-shell graphene*** **nanostructures**, including frustrated magnetic states, spin-polarized bands, and spin chains.
- SPRING will demonstrate the emergence of π-magnetization and unveil the time and energy scales of ***spins in the open-shell structures*** through a combination of scanning probe and electron spin resonance spectroscopies and develop novel predictive models of their quantum functionality.
- The ***potential of graphene open-shell platforms*** as a novel paradigm in spin-based logic devices will be tested by incorporating them into model devices and electrically addressing and manipulating spins.

RESEARCH METHODOLOGY

SPRING is organized in three scientific WPs (work packages) addressing the research objectives of SPRING, and two WPs for dissemination, communication, exploitation & management, and coordination.

- ***WP1*** will use in-solution organic synthesis, exploratory Density Functional Theory, and mean-field Hubbard simulations, on surface synthesis and high-resolution probe microscopy (AFM & STM).
- ***WP2*** uses scanning tunneling spectroscopy (STS) measurements of spin-dependent-electrical fingerprints, Atomic Force Spectroscopy, DC magnetization, Pulsed-Electron Spin Resonance (ESR) and Electron-Nuclear Double Resonance (ENDOR), DFT and model simulations.
- ***WP3*** will use transport measurements in three-therminal device (3TD) geometries and in STM, charge manipulation with AFM, DFT and mean-field Hubbard simulations, phenomenological theory, pulsed ESR and ESR based nuclear spin spectroscopy experiments (ESEEM, HYSCORE, and ENDOR).
- ***WP4*** will be in charge for the dissemination, communication and exploitation of activities and research results.
- ***WP5*** will deal with the scientific and administrative management of SPRING.

Overview of the different work packages and their tasks