Diego Frustaglia
University Seville

Geometric and topologic imprints on spin dynamics

Research on spin geometric (Berry) phases in mesoscopic systems has been active for about 30 years [1]. Still, incontrovertible evidence of their presence was found only recently [2] in mesoscopic rings subject to spin-orbit coupling (Rashba rings) in agreement with a previous theory [3], giving a new impulse to the field. Here, we discuss some new prospects for electronic manipulation based on the control of the spin geometric phases by effective-field engineering in nanodevices such as Rashba interferometers. The possibilities run from a purely geometric manipulation of electron spins (weak fields) [4] to topological transitions (large fields) [5]. Moreover, we notice that similar physics plays a role in spin resonance under driving fields that undergo a topological transition. We find [6] that, despite the strongly non-adiabatic effects dominating the spin dynamics, the field's topology appears clearly imprinted in the spin states. This has remarkable consequences on the spin resonance condition, suggesting a whole new class of experiments to spot topological transitions in the dynamics of spins and other two-level systems (from nuclear magnetic resonance to strongly-driven superconducting qubits).