Electrical Manipulation of Spin in Phosphorene Quantum Dots

Tanmay Thakur[1,*], Francois M. Peeters[**], Bartłomiej Szafran[*]
[*]*AGH University of Science and Technology,*
Faculty of Physics and Applied Computer Science,
al. Mickiewicza 30, 30-059 Kraków, Poland
[**]*Department of Physics, University of Antwerpen,*
Groenenborgerlaan 171, B-2020 Antwerp, Belgium.
[1]*thakur@agh.edu.pl*

Manipulating spins with electric fields stands as a fundamental aspect in the development of spin-based qubit devices. In this study, we delve into electric dipole spin resonance (EDSR)[1] induced by oscillating electric field within a system of double quantum dots formed electrostatically in monolayer phosphorene. Apart from the observed anisotropy of effective masses, phosphorene [2, 3] has recently been predicted to exhibit anisotropic spin-orbit coupling [4, 5]. We investigate a system comprising two electrons confined within double quantum dots, employing a single-band effective Hamiltonian [6] and using configuration interaction theory to model the time evolution of the ground state. We examine spin flips resulting from singlet-triplet transitions driven by external AC electric fields, both near and away from the Pauli blockade regime, revealing sub-nanosecond transition times. Furthermore, we analyze the impact of anisotropy by comparing dots arranged along a different axis. The subharmonic multi-photon transitions and Landau-Zener-Stueckelberg-Majorana transitions are discussed.

References

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