

# Geometric spin manipulation in semiconductor quantum dots

Sanjay Prabhakar,<sup>1</sup> Roderick Melnik,<sup>1</sup> and Akira Inomata<sup>2</sup>

<sup>1</sup>M2NeT Laboratory, Wilfrid Laurier University, 75 University Avenue West, Waterloo,  
Ontario N2L 3C5, Canada

<sup>2</sup>Department of Physics, State University of New York at Albany, Albany, New York 12222,  
USA

**Abstract:** - We propose a method to flip the spin completely by an adiabatic transport of quantum dots. We show that it is possible to flip the spin by inducing a geometric phase on the spin state of a quantum dot. We estimate the geometric spin flip time (approximately 2 ps) which turned out to be much shorter than the experimentally reported decoherence time (approximately 100 ns) that would provide an alternative means of flipping the spin before reaching decoherence. It is important that both the Rashba coupling and the Dresselhaus coupling are present for inducing a phase necessary for spin flip. If one of them is absent, the induced phase is trivial and irrelevant for spin-flip (Applied Physics Letters 104, 142411, 2014).