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An exactly solvable model for a strongly spin-orbit-coupled nanowire quantum dot[1] RUI LI, Beijing Computational Science Research Center, LIAN-AO WU, University of the Basque Country, XUEDONG HU, University at Buffalo, SUNY, J.Q. YOU, Beijing Computational Science Research Center —
In the presence of spin-orbit coupling, quantum models for semiconductor materials are generally not exactly solvable. As a result, understanding of the strong spin-orbit coupling effects in these systems remains incomplete. Here we develop a method to solve exactly the one-dimensional hard-wall quantum dot problem for a single electron in the presence of a strong spin-orbit coupling and a finite magnetic field. This method allows us to obtain the exact eigenenergies and eigenstates for the single electron. With the help of this solution, we demonstrate unique effects from the strong spin-orbit coupling in a semiconductor quantum dot, in particular the anisotropy of the electron g-factor and its tunability.

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