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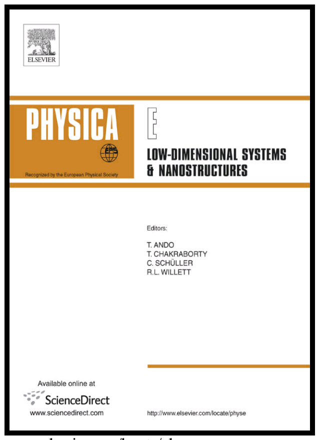

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Quantum-confined Stark effect in band-inverted junctions

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Abstract

Topological phases of matter are often characterized by interface states, which were already known to occur at the boundary of a band-inverted junction in semiconductor heterostructures. In IV-VI compounds such interface states are properly described by a two-band model, predicting the appearance of a Dirac cone in single junctions. We study the quantum-confined Stark effect of interface states due to an electric field perpendicular to a band-inverted junction. We find a closed expression to obtain the interface dispersion relation at any field strength and show that the Dirac cone widens under an applied bias. Thus, the Fermi velocity can be substantially lowered even at moderate fields, paving the way for tunable band-engineered devices based on band-inverted junctions.

Keywords: Stark effect, Fermi velocity, topological insulator
PACS: 73.20.At, 73.22.Dj, 81.05.Hd

1. Introduction

The advent of topology in condensed matter physics has drawn renewed attention to band-inverted semiconductors. These systems were first reported by Dimmock *et al.* in 1966 [1]. They showed that the fundamental gap between the bands with symmetries L_6^- (conduction band) and L_6^+ (valence band) in $Pb_{1-x}Sn_xTe$ decreases monotonically upon increasing the Sn fraction and then reopens with the order of the bands inverted relative to those of PbTe. Nowadays, ternary compounds $Pb_{1-x}Sn_xTe$ and $Pb_{1-x}Sn_xSe$ are known to be topological crystalline insulators [2, 3, 4].

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