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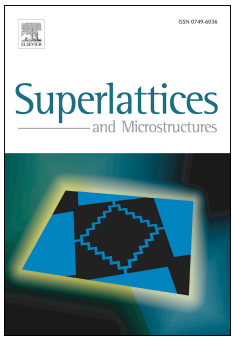

Emergence of electromotive force by time dependent gauge fields in monolayer graphene

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Emergence of electromotive force by time dependent gauge fields in monolayer graphene

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Abstract

We propose a valley-dependent electromotive force in a graphene device based on a deformed graphene in the presence of magnetic field. The coexistence of the strain and magnetic field in the presented mechanism leads to a valley dependent electromotive force in zero Fermi energy. In the non-zero Fermi energies strain alone could induce a valley dependent electromotive force while the magnetic field alone could not induce any electromotive force in zero and any level of Fermi energy. The calculations are based on the Berry curvature approaches.

Keywords: graphene monolayer, strain, magnetic field, Berry curvature, electromotive force

1. Introduction

Manipulation of material properties by external parameters is of fundamental interest in condensed matter physics. It was realized that the electric and optical properties of graphene honeycomb structure could be effectively manipulated by magnetic field and external strain [1, 2, 3, 4, 5, 6, 7]. New, intriguing phenomena were also observed in graphene that directly depend on the linear dispersion of graphene where some of these results deserve more attention. It was realized that graphene supports additional quantum numbers such as pseudo-spin and valley [8, 9, 10, 11, 12, 13, 14].

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