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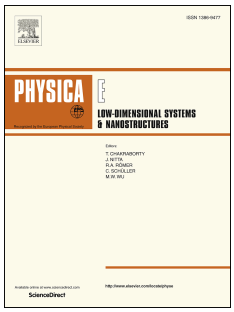

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Nonlinear optical absorption and cyclotron–impurity resonance in monolayer silicene

N.V.Q. Binh[a], Nguyen N. Hieu[a], Chuong V. Nguyen[b], Huynh V. Phuc[c], Bui D. Hoi[d,*], Le T.T. Phuong[e,*], Tran C. Phong[f]

[a] *Institute of Research and Development, Duy Tan University, 03 Quang Trung, Da Nang, Vietnam*
[b] *Department of Materials Science and Engineering, Le Quy Don Technical University, Ha Noi, Vietnam*
[c] *Division of Theoretical Physics, Dong Thap University, Dong Thap, Vietnam*
[d] *Department of Physics, University of Education, Hue University, Hue, Vietnam*
[e] *Center for Theoretical and Computational Physics, University of Education, Hue University, Hue, Vietnam*
[f] *The Vietnam National Institute of Educational Sciences, Hanoi, Vietnam*

Abstract

The magneto-optical transport properties in monolayer silicene subjected simultaneously to a perpendicular magnetic field and an electromagnetic wave (optical field) are theoretically studied. The nonlinear absorption coefficient is calculated using perturbation theory taking account of the electron–impurity scattering. The cyclotron–impurity resonance (CIR) is observed through the absorption spectrum. The photon energy at resonances is found to be proportional to the square root of magnetic field. This behaviour is similar to that in graphene but different from that in conventional low-dimensional semiconductors. The full width at half maximum (FWHM) of CIR peaks increases with increasing magnetic field by the laws FWHM [meV] $\approx 0.432\sqrt{B[\mathrm{T}]}$ and FWHM [meV] $\approx 0.215\sqrt{B[\mathrm{T}]}$ for one- and two-photon absorption, respectively. The obtained FWHM is about one order of magnitude smaller than it is in graphene monolayers. Moreover, the temperature dependence of the FWHM is similar to that in graphene but different from that in conventional low-dimensional semiconductors.

*Corresponding author. Tel: +84-979515588
Email addresses: buidinhhoi@hueuni.edu.vn (Bui D. Hoi), thuphuonghueuni@gmail.com (Le T.T. Phuong)