## Accepted Manuscript

Title: Cavity-enhanced optical Hall effect in epitaxial graphene detected at terahertz frequencies

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PII: S0169-4332(16)32118-3

DOI: http://dx.doi.org/doi:10.1016/j.apsusc.2016.10.023

Reference: APSUSC 34117

To appear in: APSUSC

Received date: 7-8-2016 Revised date: 4-10-2016 Accepted date: 4-10-2016

Please cite this article as: Nerijus Armakavicius, Chamseddine Bouhafs, Vallery Stanishev, Philipp K*ddotu*hne, Rositsa Yakimova, Sean Knight, Tino Hofmann, Mathias Schubert, Vanya Darakchieva, Cavity-enhanced optical Hall effect in epitaxial graphene detected at terahertz frequencies, <![CDATA[Applied Surface Science]]> (2016), http://dx.doi.org/10.1016/j.apsusc.2016.10.023

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## ACCEPTED MANUSCRIPT

# Cavity-enhanced optical Hall effect in epitaxial graphene detected at terahertz frequencies

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#### Abstract

Cavity-enhanced optical Hall effect at terahertz (THz) frequencies is employed to determine the free charge carrier properties in epitaxial graphene (EG) with different number of layers grown by high-temperature sublimation on 4H-SiC(0001). We find that one monolayer (ML) EG possesses p-type conductivity with a free hole concentration in the low 10<sup>12</sup> cm<sup>-2</sup> range and a free hole mobility parameter as high as 1550 cm<sup>2</sup>/Vs. We also find that 6 ML EG shows n-type doping behavior with a much lower free electron mobility parameter of 470 cm<sup>2</sup>/Vs and an order of magnitude higher free electron density in the low 10<sup>13</sup> cm<sup>-2</sup> range. The observed differences are discussed. The cavity-enhanced THz optical Hall effect is demonstrated to be an excellent tool for contactless access to the type of free charge carriers and their properties in two-dimensional materials such as EG.

Keywords: THz optical Hall effect, epitaxial graphene, free charge carrier properties

### 1. Introduction

Graphene has attracted significant scientific interest due to its outstanding electronic properties, which arise from the linear electronic band structure resulting in massless Diractype fermion behavior [1, 2]. Epitaxial graphene (EG) grown on silicon carbide (SiC) by sublimation allows wafer-scale production of large-area homogeneous graphene on semi-insulating substrates that could be easily integrated in the current device fabrication technologies [3, 4, 5]. However, EG is significantly affected by the substrate properties and shows lower free charge carrier mobility compared to exfoliated graphene transferred on

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Preprint submitted to Applied Surface Science

October 4, 2016

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