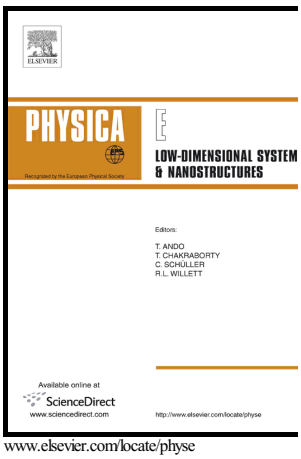
Magnetoresistance oscillations of two-dimensional electron systems in lateral superlattices with structured unit cells

Rolf R. Gerhardts



www.elsevier.com/locate/physe

PII: S1386-9477(15)30099-0
DOI: http://dx.doi.org/10.1016/j.physe.2015.06.027
Reference: PHYSE12014

To appear in: *Physica E: Low-dimensional Systems and Nanostructures*

Received date: 12 May 2015
Revised date: 23 June 2015
Accepted date: 25 June 2015

Cite this article as: Rolf R. Gerhardts, Magnetoresistance oscillations of two dimensional electron systems in lateral superlattices with structured unit cells *Physica E: Low-dimensional Systems and Nanostructures* http://dx.doi.org/10.1016/j.physe.2015.06.027

Magnetoresistance oscillations of two-dimensional electron systems in lateral superlattices with structured unit cells

Rolf R. Gerhardts

Max-Planck-Institut für Festkörperforschung, Heisenbergstrasse 1, D-70569 Stuttgart, Germany

Abstract

Model calculations for commensurability oscillations of the low-field magnetoresistance of two-dimensional electron systems (2DES) in lateral superlattices, consisting of unit cells with an internal structure, are compared with recent experiments. The relevant harmonics of the effective modulation potential depend not only on the geometrical structure of the modulated unit cell, but also strongly on the nature of the modulation. While higher harmonics of an electrostatically generated surface modulation are exponentially damped at the position of the 2DES about 90 nm below the surface, no such damping appears for strain-induced modulation generated, e.g., by the deposition of stripes of calixarene resist on the surface before cooling down the sample.

Keywords:

magnetotransport, two-dimensional electron systems, lateral superlattice, Weiss oscillations

1. Introduction

The calculations presented here are motivated by recent magnetoresistance experiments [1, 2] on two-dimensional electron systems (2DES) in $Al_xGa_{1-x}As$-heterostructures with a special type of periodic surface modulation. The modulation of the 2DES, located 90 nm below the sample surface, was achieved by depositing a periodic array of identical, parallel metal stripes, with three stripes per unit cell, onto the sample surface. The three

Email address: R.Gerhardts@fkf.mpg.de (Rolf R. Gerhardts)