



Contribution ID: 132

Type: Oral Presentation

## Implementation of Quantum Hall Effect Based Precision Resistance Measurement System

*Tuesday, 4 July 2017 10:20 (20 minutes)*

The National Metrology Institute of South African (NMISA) has a mandate to implement a primary resistance standard and to upgrade the DC resistance Laboratory. The Quantum Hall Effect (QHE) is the foundation for the implementation of the primary resistance standard. The QHE is a phenomenon that occurs in a two-dimensional electron gas (2DEG) when subject to a strong magnetic field perpendicular to the direction of current flow when the system is cooled down to low temperatures. MOSFETs or GaAs/AlGaAs devices are used for the QHE. The GaAs/AlGaAs heterostructure is the preferred material due to its high mobility  $\mu$  and carrier concentration  $n$ .

Electron density in the range of  $(3 \text{ to } 5.5) \times 10^{15} \text{ m}^{-2}$  is suitable in order to obtain wide and well quantised  $\nu=2$  plateau at 1.5 K and magnetic field in the range of 6 T to 11 T (Delahaye & Jeckelmann, 2003). The passing of current in the 2DEG in the presence of a strong magnetic field results in a transverse voltage called the Hall voltage  $V(H)$ , the ratio of the Hall voltage to current has the units of resistance ( $\Omega$ ). The Hall voltage manifests itself as quantised plateaus where each plateau is a multiple of the Klaus von Klitzing constant given by

$$R_K = h/e^2 = 25812.807 \Omega$$

which is given by fundamental constants. In this talk, I will present an introduction to the techniques used to realise a standard of electrical resistance based on the QHE and show the latest results from our group in the Department of Physics at UCT.

**Apply to be considered for a student award (Yes / No)?**

Yes

**Level for award (Hons, MSc, PhD, N/A)?**

MSc

**Main supervisor (name and email) and his / her institution**

Mark Blumenthal  
mark.blumenthal@uct.ac.za  
UCT

**Would you like to submit a short paper for the Conference Proceedings (Yes / No)?**

No

**Primary author:** Mr MABOKO, Mporome (Student)

**Presenter:** Mr MABOKO, Mporome (Student)

**Session Classification:** Physics of Condensed Matter and Materials 1

**Track Classification:** Track A - Division for Physics of Condensed Matter and Materials