

## Possible observation of Berry phase in Aharonov-Bohm rings of InGaAs

A. Aharony, O. Entin-Wohlman, L. Tzarfati, V. Shelukhin, M. Karpovski, V. Umansky,  
and A. Palevski

*Raymond and Beverly Sackler School of Physics and Astronomy, Tel-Aviv University, Tel Aviv 69978, and  
Physics Department, Ben Gurion University, Beer Sheva 84105, and  
Dept. of Condensed Matter Physics, Weizmann Institute of Science, Rehovot, 76100, Israel*

Distinct beating patterns superimposed on the Aharonov-Bohm oscillations are observed over a wide range of magnetic fields, up to 0.7 Tesla at the relatively high temperature of 1.5 K in the two-dimensional electron gas formed in InGaAs/AlInAs heterostructures (see Fig. 1 below). The possibility that these beats are due to the interplay between the Aharonov-Bohm and Berry phases, different for electrons of opposite spins in the presence of strong spin-orbit and Zeeman interactions in ring geometries, is carefully investigated. Although the proposed mechanism cannot be ruled out, it is possible that the observed modulation is due to the existence of a few geometrically different electronic paths within the ring's width.

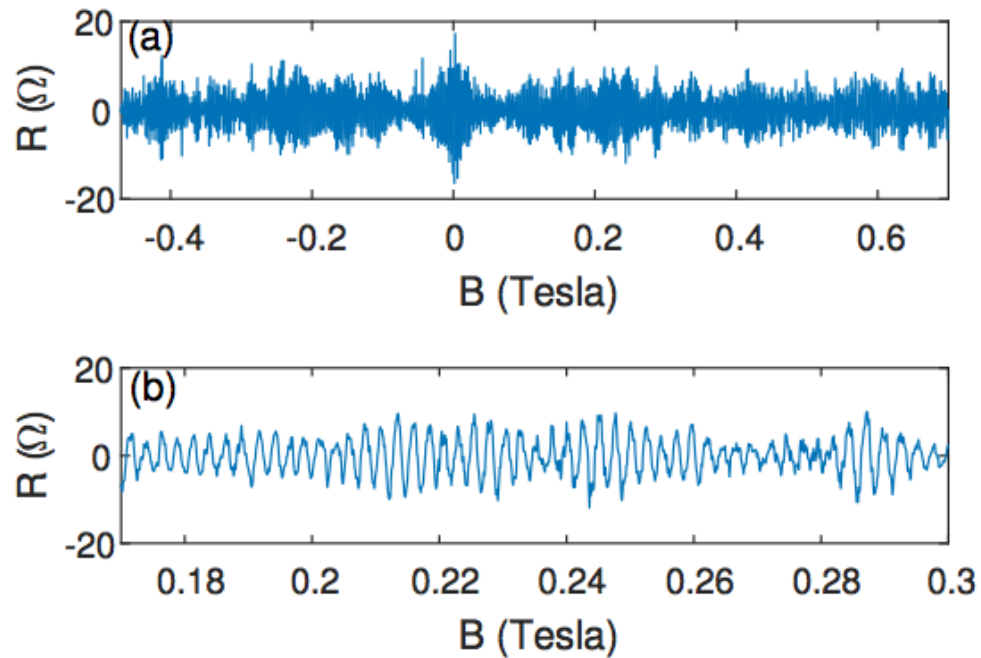


Fig. 1. (a) Magnetoresistance of an Aharonov-Bohm ring at 1.5 K, in wide range of magnetic field, up to  $B = 0.7$  T; (b) The same in a narrow field range around  $B = 0.25$  T.