Aharonov-Bohm-type Oscillations in a System of Two Tunnel Point-Contacts in the Presence of a Single Scatterer: Determination of the Depth of the Buried Impurity

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The conductance of a system containing two tunnel point-contacts (geometry of double-tip STM experiment) and a single subsurface scatterer nearby is investigated theoretically. It is shown that in the presence of a magnetic field the conductance undergoes Aharonov-Bohm type oscillations. They result from a magnetic flux penetrating through the area which is formed by the line connecting the contacts and the trajectories of electrons moving from one contact to the scatterer and after the scattering event arrives at the second contact. In a weak magnetic field the mentioned area is a triangle with a known base (distance between the contacts). A measurement of the period of oscillations which is defined by the magnetic flux quantum is a simple way to find the square of the electron trajectory and hence a depth of the defect below the sample surface. In this work analytical expressions for the wave function and the conductance of the system are obtained. The dependence of the conductance on the value and direction of the magnetic field is analyzed. On the basis of these theoretical investigations a new method to determine the defect position below the surface is proposed