Effect of a strain on the magnetotransport properties of Bi wires

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The presented investigations of the magnetotransport measurements of Bi wires complement the series of recently published experimental results on bulk Bi in high magnetic field. The design of measurements in the magnetic field was diversified by using uniaxial strain directed along the wire axis. By combining high magnetic field and strain, the electronic structure of the bismuth wires was modified; as a result, the quantum limit for light and heavy electrons could be changed in different ways. Measurements of the longitudinal magnetoresistance in the magnetic field of up to 35 T oriented along the bisector axis of Bi wires have revealed an anomaly in a magnetic field far above the quantum limit of the electrons: a sharp peak of MR at 33T (figure 1). Investigation of magnetoresistance under uniaxial strain has revealed that the sharp peak of the magnetoresistance at 33 T is reproduced in lower magnetic fields at 28 T according to a decrease in the light electron concentration under strain. Thus, a correlation between the exit of the last Landau level of light electrons and the Lifshitz Transition has been found. The result is that the critical magnetic field of the Electronic Topological Transition has decreased; thereby, the magnetic field range of the occurrence of magnetic-field-induced instabilities associated with the last Landau level of electrons has been extended. It should also be noted that a decrease in the resistance in higher fields with the apparent metallization of bismuth indicates possible changes in the mechanism of carrier scattering associated also with the Lifshitz Transition and with the substructure of the last Landau level of electrons.

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