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Quasi-2D magnetotransport in heavily doped 3D topological insulator $\text{Bi}_2\text{Se}_3\text{Cu}_x$: Shubnikov-de Haas oscillations and π -Berry phase

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π -Berry phase is one of the main fundamental transport properties associated with the topological characteristics of a class of topological insulators. To increase the accuracy of Berry phase determination by means of the Shubnikov-de Haas (SdH) oscillations phase analysis we present a study of n-type in heavily doped high-quality $\text{Bi}_2\text{Se}_3\text{Cu}_x$ single crystals with bulk carrier density $n \sim 10^{19} - 10^{20} \text{ cm}^{-3}$ at high magnetic field up to 60 Tesla and at temperatures down to 0.3 K. In particular, Landau level fan diagram starting from the value of the Landau index $N=4$ was plotted. Thus, from our data, we found π -Berry phase that directly indicates the Dirac nature of the carriers in a three-dimensional topological insulator (3D TI) based on Cu-doped bismuth selenide. We argued that in our samples the magnetotransport is determined by a general group of carriers that exhibit quasi-two-dimensional (2D) behavior and are characterized by topological π -Berry phase. Along with the main contribution to the conductivity the presence of a small group of bulk carriers was detected. The second contribution relates to 3D Fermi surface and is characterized by a zero Berry phase, inherent for trivial states in metals with parabolic dispersion.

Biography

Taisiia A Romanova has completed her PhD in the year 2017 at the age of 28 years Lebedev Physical Institute of the Russian Academy of Sciences (LPI RAS). The title of PhD thesis is "Transport, magnetotransport and superconducting properties of three dimensional topological insulators based on bismuth chalcogenides. She is the researcher of VL Ginzburg Center of High-Temperature Superconductivity and Quantum Materials (LPI RAS). In 2013 being a participant of the youth research group. She was awarded with S.I. Vavilov prize of youth competition for series of studies of quantum oscillations in topological insulators. At the moment, she is the head of the youth project to study transport and superconducting properties of three-dimensional topological insulators based on layered single crystals of bismuth and tin chalcogenides. Also she is involved in long-term project to study transport, magnetotransport properties of «iron superconductors». Taisiia A Romanova has published 8 papers in refereeing scientific journals. She repeatedly made scientific reports (over 15) at the leading international conferences in the field of condensed matter physics and strongly correlated electronic systems.

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