Superconductivity in PbTe/SnTe semiconductor heterostructure: a candidate for spin-triplet superconductor

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The superconductivity of IV-VI semiconductor heterostructures has been a puzzling phenomenon for many years [1,2]. The underlying mechanism seems to be based on the inversion of the band structure induced by compression due to periodic dislocation grids on the interfaces, which gives rise to topological crystalline insulator surface states [3]. At the same time, the resulting periodically varying strain acting on these states creates topological flat band, which promotes superconducting phase transition [4]. However, the pairing mechanism behind this superconductivity has not yet been fully demonstrated, to the best of our knowledge.

Here we present the results of soft point contact spectroscopy (PCS) of superconducting PbTe/SnTe heterostructures, in which the presence of dislocations was revealed using transmission electron microscopy. The PCS experiments exhibit a distinct zero-bias conductance peak (ZBCP). It can be fitted within a theoretical model involving an Anderson-Brinkman-Morel electron pairing potential [5]. This superconducting mechanism realizes p-wave pairing symmetry and was initially introduced to explain the spin-triplet phase of the superfluid ^{3}He. Recent works have expanded this formalism to explain flatband-induced superconductivity [6].

In the PCS experiments, we used both silver and nickel contacts (normal metal and highly spin-polarized metal). The observed spectra do not depend on the spin polarization, which is a signature of p-wave pairing potential [5]. We will present a discussion that sheds light on the mechanism of the unconventional superconductivity observed in this class of narrow-gap semiconductor heterostructures.

The research was partially supported by the Foundation for Polish Science through the IRA Programme co-financed by EU within SGOP and the National Science Centre (Poland) through OPUS (UMO-2017/27/B/ST3/02470) project.

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