Selective-area-epitaxied PbTe-superconductor nanowire devices as a new platform for topological quantum computing

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Semiconductor-superconductor hybrid nanowire is one of the major platforms for realizing Majorana zero modes (MZMs) and topological quantum computing (TQC), and the III-V InAs and InSb-based nanowires are the most-studied materials in this approach. Despite years of efforts on material improvement and optimization, too many defects and impurities in the nanowire samples remain the central problem hindering the research progress in the direction. In recent years, a new candidate Majorana nanowire system—IV-VI semiconductor PbTe-superconductor hybrid nanowire—have attracted much attention and witnessed rapid research progress. The unique advantages of PbTe-based nanowires, such as the large dielectric constant and the existence of a lattice-matched substrate, grant them great potential in overcoming the bottleneck problem of sample defects and impurities and becoming an ideal platform to study MZMs and TQC. In this talk, I will briefly introduce the recent research progress on selective-area molecular beam epitaxy growth and transport characterization of in-plane PbTe nanowires and PbTe-superconductor hybrid nanowires, and discuss the advantages and problems of the new candidate Majorana nanowire system, as well as the prospective of realizing TQC based on it.