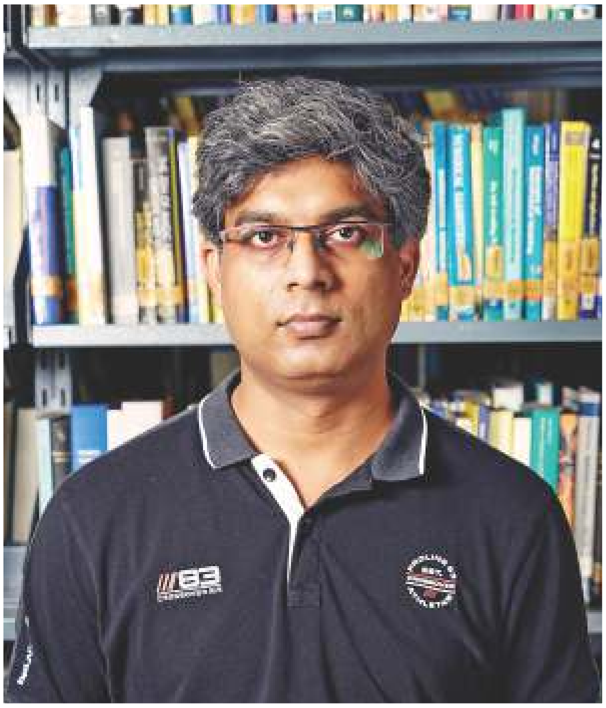

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Areas of Research

Magneto transport properties of topological quantum materials

We work on the single crystal growth and electrical transport properties of topological materials of various kinds. It all starts with the growth of single crystals of many topologically important materials such as Dirac semimetals (Cd_3As_2, $HfTe_5$, $ZrTe_5$), Weyl semimetals (1T'-$MoTe_2$, Td-WTe_2, TaP, GdPtBi, WP_2, MoP_2), nodal line semimetals (ZrSiS, HfSiS), topological insulators (LaBi, LaSb) and many more. For this, we employ various crystal growth techniques such as metal flux and chemical vapor transport (CVT) to be used in this project. I also work on transport properties of van der Waals materials such as $MoTe_2$ and WTe_2, KHgSb, KMgBi (also highly air sensitive), $ZrTe_5$ and $HfTe_5$. To gain direct insight of the electronic band structure, we collaborate for angle resolved photoemission spectroscopy (ARPES) measurements and first principles calculations.

In the field of magnetic topological semimetals we work on ways to enhance anomalous Hall conductivity by maximizing Berry curvature contribution for example in ferromagnets $Co_3Sn_2S_2$, $LaCrGe_3$, MnAlGe etc. The experience gained with these materials will help us establish the relation between the bulk anomalous Hall conductivity and 3D quantum anomalous Hall effect.

Plan of Future Work Including Project

We plan to work on the magneto-transport properties of topological quantum materials under pressure and two-dimensional limits. For, high pressure we will establish the facility of diamond anvil cell and piston-based pressure cell. The work on two dimensional materials will entail growing single crystals of layered ferromagnets and exfoliate them and make devices to attain the goal of quantum anomalous Hall effect at high temperature. We will also study structurally 3D but magnetically 2D ferromagnets to realize 3D quantum anomalous Hall system analogues. We will study quasi one dimensional quantum materials to explore novel quantum states such as axion insulators.