

Abstract Submitted
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Observation of a macroscopic topological insulator phase in an assembly of coupled topological insulator nanocrystals¹ DIPTIMAN SEN, ABHISHEK BANERJEE, OINDRILA DEB, KUNJALATA MAJHI, R GANESAN, P. S. ANIL KUMAR, Indian Institute of Science, Bangalore — We study an assembly of tunnel coupled topological insulator (TI) nanocrystals. We demonstrate experimentally that a macroscopic topological insulator phase can emerge in this system. Electrical transport measurements on thin films of Bi₂Se₃ nanocrystals reveal the presence of decoupled top and bottom topological surface states above a certain film thickness. The surface state penetration depth is found to be unusually large, $\sim 30\text{nm}$ at 2K, and decreases with increasing temperature. For samples with low film thickness, we observe deviations of the surface state Berry phase from π due to hybridization of opposite surface states. This weakens the effective spin-orbit coupling field to as low as $\sim 30\text{T}$ at 2K. Remarkably, the topological insulating behavior becomes more pronounced with increasing temperature. Our work exhibits a model TI that is distinct from bulk/single crystal TIs and also displays phenomena that are expected, but normally not accessible in the latter systems.

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Diptiman Sen
Indian Institute of Science, Bangalore

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