UNIVERSITÄT DUISBURG ESSEN

PHYSIK E=

Physikalisches Kolloquium

Mittwoch, 27.11.2024
13:00 Uhr
MC 122 und Zoom

https://uni-due.zoom-x.de/j/64228670246?pwd=RjVQeFNIUkRKRkpiNVpKYXhJaFNLdz09 (gilt für alle Vorträge)

Surface transport in nanograined Bi_2Te_3 and SnTe

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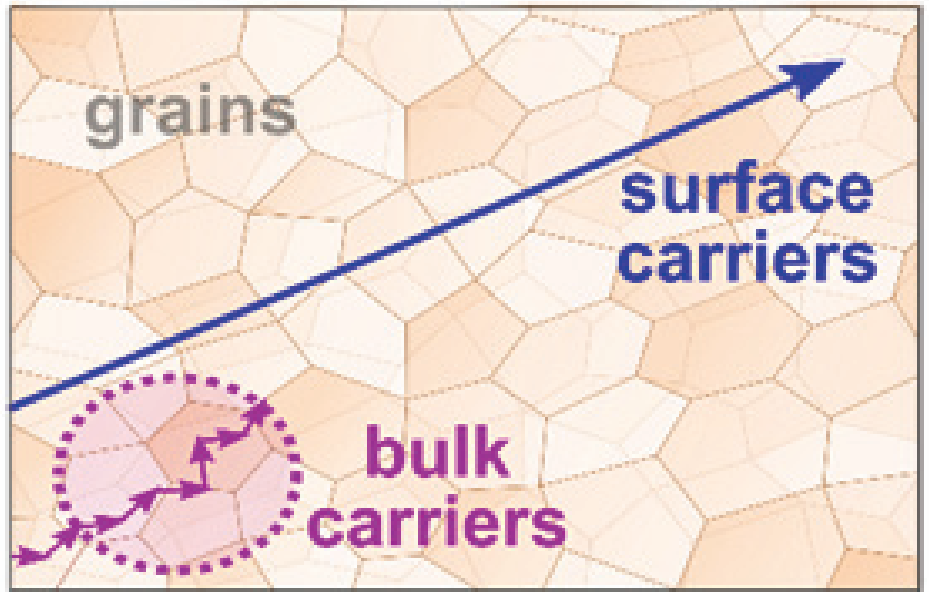

Topological insulators such as Bi2Te3 or SnTe exhibit two-dimensional (2D) surface charge carriers with topological protection and three-dimensional volume charge carriers. The outstanding electronic properties of the 2D surface charge carriers are often not clearly visible in experiments due to their relatively small number compared to the 3D volume charge carriers and are lost in the noise. We circumvent this problem by using nanogranular samples or nanocrystalline sputtered thin films, which increase the proportion of 2D surface charge carriers due to many interfaces. However, this then raises an interesting fundamental question, namely whether 2D surface charge carriers scatter at grain boundaries. We investigate this by correlating structural and electronic parameters. Our nanoparticles and nanocrystalline films had grain sizes of approximately 20–40 nm. The coherence lengths of the 2D surface charge carriers were about 100 nm to 200 nm, while the mean free paths of the 3D volume electrons were about 1 nm to 5 nm. Using THz time domain spectroscopy (Martin Mittendorff group), we measured the scattering rate of the 2D carriers and found an excellent agreement with the Hikami-Larkin-Nagaoka (HLN) model. We conclude that 2D surface charge carriers can traverse up to 10 grain boundaries without dephasing, potentially paving the way for applications.