Unveiling the Electronic Properties of α-SnTe: From Ferroelectric Distortion to Unexpected Topological Surface State

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α-SnTe offers a combination of semiconducting and ferroelectric properties, further enriched by a non-trivial topological behavior. At room temperature, SnTe has a rocksalt atomic structure with a mirror symmetry that protects a metallic topological surface state. However, when the temperature drops below a critical point, a spontaneous structural distortion occurs that not only suppresses the topological surface state but also leads to a macroscopic electric polarization, resulting in a significant Rashba splitting in the valence band.
In the first part of my presentation, I will discuss how we gain insights into the nature of the ferroelectric distortion by observing the temperature evolution of the Rashba splitting in the bulk valence band of SnTe. Our findings suggest an order-disorder phase transition with substantial deviations from a mean-field-like behavior [1].
Although ferroelectric SnTe(111) should be a trivial insulator, I will demonstrate in the second part how we can photoinduce a topological transition. Ultrashort and tailored light pulses allow us to transiently and electronically restore an unexpected topological state, even while the atomic structure remains distorted.

[1] Chassot et al. "Persistence of structural distortion and bulk band Rashba splitting in SnTe above its ferroelectric critical temperature." Nano Letters 24.1 (2023): 82-88.