

Surface Physics of Topological Insulators: Massless Electrons and Massive Ions

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The main objective of my presentation is to elucidate subtle characteristics of the novel class of materials coined *topological insulators*, and my group's contributions to our current understanding of these materials. I will begin with explaining how physicists use the relations between energy and momentum, which they call *dispersion relations*, to distinguish and characterize the motion of different particles. Emphasis will be on categories of massive and massless particles, and on special features for the motion of electrons and ions in solids. Next, I will introduce very simple topological features of common objects and reveal how simple numbers can be used to characterize topological families, and hence provide a simple way to distinguish between them. I will then use these foundations to describe the unique features of topological insulators, especially the massless character of their surface electrons. Finally, I will show how my group was able to reveal anomalous features that emerge from the interaction of the massless surface electrons with the massive surface ions. The whole presentation will be pictorial! So please concentrate and follow the evolution of my pictures as they become more complex.