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CFEL Seminar rooms I-III (DESY Bldg. 99)

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Shining Light on Topological Insulators

Topological insulators (TIs) are novel materials that do not conduct electricity in their bulk but possess exceptional conducting electronic states on their surface. These surface electrons have a number of highly unusual characteristics: (i) they behave like massless relativistic particles similar to photons (ii) their spin is locked perpendicular to their momentum and (iii) this state is robust against moderate disorder. Understanding and characterizing unique properties of these materials can lead to novel applications such as current induced magnetization or extremely robust quantum memory bits. In this talk, I will first give a brief introduction to these materials and then describe our recent experiments in which we used ultrashort laser pulses to probe and control properties of the topological surface states. Utilizing the short duration of these pulses, we succeeded in capturing femtosecond movies of the electronic energy bands in a three dimensional manner. These movies reveal an exotic hybrid state between electrons and light which was predicted theoretically but has never been observed in solids before.

