# Manipulation of spin and bandgap in topological insulators

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Topological insulators are characterized by Dirac-cone surface states with electron spins locked perpendicular to their linear momenta. Recent theoretical and experimental work implied that this specific spin texture should enable control of photoelectron spins by circularly polarized light[1,2]. However, these reports questioned the so far accepted interpretation of spin-resolved photoelectron spectroscopy. We solve this puzzle and show that vacuum ultraviolet photons (50–70 eV) with linear or circular polarization indeed probe the initial-state spin texture of $Bi_2Se_3$ while circularly polarized 6-eV low-energy photons flip the electron spins out of plane and reverse their spin polarization, with its sign determined by the light helicity (Fig. 1). We present photoemission calculations, taking into account the interplay between the varying probing depth, dipole-selection rules, and spin-dependent scattering effects involving initial and final states, which explain these findings and reveal proper conditions for light-induced spin manipulation[3]. In the second part of the talk, we discuss the opening of band gaps at the Dirac point of $Bi_2Se_3$ by magnetic impurities.

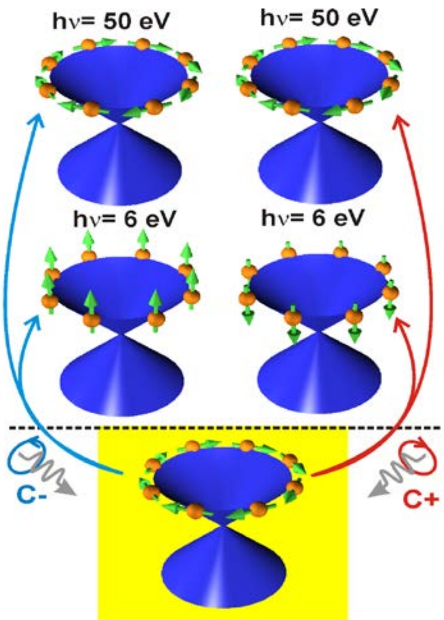


Fig. 1. The figure shows a sketch of the strong influence of photoemission final states on the measured spin texture of topological surface states.

## References

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