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Electric tuning of topological insulator states and their surface scattering MICHAEL POVOLOTSKYI, TILLMANN KUBIS, GERHARD KLIMECK, Purdue University — Materials that show the topological insulating (TI) properties have been extensively studied both experimentally and theoretically in recent years, but an application of those materials for electronic devices is still a challenge. In this study we explored a possibility to switch electric conductance of a surface TI states in a Bi_2Te_3 thin film. In such films there are two surfaces that have TI states located at them. We have done a theoretical study of the surface states using atomistic description within an empirical tight binding approximation. It was found that applying electric field perpendicular to the surface one can affect spin polarization of the TI states. Analysis of the scattering rates for electrons that occupy TI states close to the Fermi level shows that: a) the surface states are spin polarized under an applied electric field; b) the electron scattering between two surface states depends on whether they occupy the same surface and have parallel spins; c) by varying strength of an applied electric field it is possible to modulate the scattering rate, because at small fields the states are not spin-polarized, while at higher fields the states become spin-polarized, and at very high fields the surface states are significantly coupled to the bulk states.

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