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Circular photogalvanic effect on topological insulator surfaces: Berry curvature-dependent response[1] PAVAN HOSUR, University of California at Berkeley — Strong spin-orbit coupling is commonly exploited for generating electric currents using circularly-polarized light. We study, theoretically, the direct current generated by circularly-polarized light on the surface of a topological insulator, focusing on the part that reverses on switching the light-helicity. Interestingly, the dominant current, due to an interband transition, is controlled by the Berry curvature of the surface bands. This extends the connection between photocurrents and Berry curvature beyond the quasiclassical approximation where it has been shown to hold. Explicit expressions are derived for the (111) surface of the topological insulator Bi_2Se_3 where we find significant helicity-dependent photocurrents when the rotational symmetry of the surface is broken by an in-plane magnetic field or a strain. Moreover, the dominant current grows linearly with time until a scattering occurs, which provides a means for determining the scattering time. DC spin density is generated on the surface as well, and is also dominated by a linear-in-time, Berry curvature-dependent contribution.

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