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Circular photogalvanic effect in silicon nanowires SAJAL DHARA, E. J. MELE, RITESH AGARWAL, University of Pennsylvania — Circular photogalvanic effect (CPGE), the generation of a photocurrent whose magnitude and polarity depends on chirality of optical excitation, is demonstrated in the visible optical range in silicon nanowires, a bulk non-gyrotropic material with weak spin-orbit coupling. CPGE, which is absent in bulk Si is found to arise from interband transitions only at the metal-semiconductor contacts to Si nanowires where inversion symmetry is broken by a Schottky electric field. Furthermore, by applying a bias voltage that modulates this field, the sign and magnitude of the CPGE can be controlled. From excitation energy dependent measurements and symmetry considerations, it is argued that the $[1\bar{1}0]$ surface states due to Si chains that are not aligned with the nanowire growth direction and the Schottky field produce an artificial gyrotropic optical medium that supports CPGE. This work reveals the role of the surface states in the generation of chirality-dependent photocurrents in silicon with a purely orbital-based mechanism, and also opens up new possibilities of engineering new functionalities in Si that can be integrated with conventional electronics.

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