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Orbital-Selective Spin Texture and its Manipulation in a Topological Insulator ZHUOJIN XIE, SHAOLONG HE, CHAOYU CHEN, YA FENG, HEMIAN YI, AIJI LIANG, LIN ZHAO, DAIXIANG MOU, JUNFENG HE, YINGYING PENG, XU LIU, YAN LIU, GUODONG LIU, XIAOLI DONG, LI YU, JUN ZHANG, Institute of Physics, Chinese Academy of Sciences, SHENJIN ZHANG, ZHIMIN WANG, FENGFENG ZHANG, FENG YANG, QINJUN PENG, ZIAOYANG WANG, CHUANGTIAN CHEN, ZUYAN XU, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, XINGJIANG ZHOU, Institute of Physics, Chinese Academy of Sciences, IOP,CAS TEAM, IPC,CAS TEAM
— Topological insulators represent a new quantum state of matter, possessing a unique electronic structure and spin texture. In the Dirac surface state, the spin is locked with the crystal momentum. Here we report a new phenomenon of the spin texture locking with the orbital texture in a TI Bi2Se3. The laser-based SARPES can directly measure the spin texture of both the upper and lower Dirac cones in Bi2Se3 surface state under different light polarizations. An unexpected spin texture is revealed for the first time in the s-polarization geometry that the upper Dirac cone exhibits the same spin chirality with the lower one, while the opposite spin chirality is observed for the upper and lower Dirac cones in the p-polarization geometry. Because different orbitals and their coupled spin texture are selectively probed by using variable light polarizations, these results constitute strong evidence of the orbital-dependent spin texture in Bi2Se3.

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