Temperature-dependent Helicity of In-gap states of SmB$_6$\(^1\) SOOY-OUNG JANG, Lawrence Berkeley Natl Lab, POSTECH, J.D. DENLINGER, Lawrence Berkeley Natl Lab, C.-H. MIN, F. REINERT, U. Würzburg, BOYOUN KANG, B.-K. CHO, GIST, D.J. KIM, Z. FISK, UC Irvine, KEUN SU KIM, POSTECH, J. W. ALLEN, U. of Michigan — Mixed-valent SmB$_6$ with a temperature (T) dependent bulk gap is the first candidate example of a new class of strongly correlated topological insulators with $f$-$d$ band inversion. Previous angle-resolved photoemission (ARPES) on cleaved $<100>$ surfaces of SmB$_6$ have quantified the T-evolution of (i) the Sm 4$f$ state coherence, (ii) the X-point $f$-conduction band energy and many-body gap destabilization, and (iii) the intimately connected fate of in-gap states. In this work we additionally characterize the T-evolution of the in-gap state orbital angular momentum helicity using circular dichroism. We show that the onset of dichroism, above 100K, coincides with the dimensional crossover from high T 3D non-helical bulk $d$-band states crossing $E_F$ to low T 2D in-gap surface states where the dichroic asymmetry reaches 100%. With the assumption of topological surface state anti-parallel spin-momentum locking, this result can be viewed as supporting previous spin-resolved ARPES measurements of in-gap state helical spin structure.

\(^1\)Supported by U.S. DOE at the Advanced Light Source (DE-AC02-05CH11231).