Anomalous Cooper pair interference on Bi$_2$Te$_3$ surface LI LU, JIE SHEN, YUE DING, YUAN PAN, FAN YANG, FANMING QU, ZHONGQING JI, XIUNIAN JING, JIE FAN, GUANGTONG LIU, CHANGLI YANG, GENGHUA CHEN, Institute of Physics, CAS — We have performed phase-sensitive measurements on particularly designed superconducting quantum interference devices constructed on the surface of topological insulators Bi$_2$Te$_3$ in such a way that a substantial portion of the interference loop is built on the proximity-effect-induced superconducting surface. Two types of Cooper interference patterns have been recognized at low temperatures. One is $s$-wave like and is contributed by a zero-phase loop inhabited in the bulk of Bi$_2$Te$_3$. The other, being identified to relate to the surface states, is anomalous for that there is a phase shift between the positive and negative bias current directions. The results support that the Cooper pairs on the surface of Bi$_2$Te$_3$ have a $2\pi$ Berry phase which makes the superconductivity $p$-wave-like. Mesoscopic hybrid rings as constructed in this experiment are presumably arbitrary-phase loops suitable for studying topological quantum phenomena.


Li Lu
Institute of Physics, CAS

Date submitted: 15 Nov 2013

Electronic form version 1.4