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Majorana zero modes in Dirac semimetal Josephson junctions CHUAN LI, JORRIT DE BOER, BOB DE RONDE, Univ of Twente, YINGKAI HUANG, MARK GOLDEN, Univ of Amsterdam, ALEXANDER BRINKMAN, Univ of Twente — We have realized proximity-induced superconductivity in a Dirac semimetal and revealed the topological nature of the superconductivity by the observation of Majorana zero modes. As a Dirac semimetal, $Bi_{0.97}Sb_{0.03}$ is used, where a three-dimensional Dirac cone exists in the bulk due to an accidental touching between conduction and valence bands. Electronic transport measurements on Hall-bars fabricated out of $Bi_{0.97}Sb_{0.03}$ flakes consistently show negative magnetoresistance for magnetic fields parallel to the current, which is associated with the chiral anomaly. In perpendicular magnetic fields, we see Shubnikov-de Haas oscillations that indicate very low carrier densities. The low Fermi energy and protection against backscattering in our Dirac semimetal Josephson junctions provide favorable conditions for a large contribution of Majorana zero modes to the supercurrent. In radiofrequency irradiation experiments, we indeed observe these Majorana zero modes in Nb-$Bi_{0.97}Sb_{0.03}$-Nb Josephson junctions as a 4π periodic contribution to the current-phase relation.

Jorrit De Boer
Univ of Twente

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