Majorana-Weyl fermions in (2+1)-dimensional superconductors

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The topic of Majorana fermions is interesting in relation to both condensed-matter physics and high-energy physics. To study Majorana fermions in superconductors, we performed electric transport measurements at an edge of a chiral single domain of Sr_2RuO_4. Surprisingly, we found anomalous current-voltage ($I-V$) curves. The induced voltage shows an *even* function of the bias current in four terminal measurements. The parity-violating $I-V$ curves are dependent on the direction of the applied magnetic field parallel to c axis. In the vicinity of 450 Oe, the induced voltage changes from a positive voltage of $V(+I) = V(-I)$ to a negative voltage of $-V(+I) = -V(-I)$. The result revealed spontaneous magnetization and a change in the chirality of the single domain Sr_2RuO_4. In addition, the zero-bias conductance peak through the tunnel junction at an edge of a microscale Sr_2RuO_4 crystal shows the existence of the gapless chiral Majorana state. Thus, we discuss excitation of Majorana-Weyl fermions along the edge of the single domain under bias current in order to understand the parity-violating $I-V$ curves.[1]

[1]H. Nobukane, A. Tokuno, T. Matsuyama, S. Tanda, Phys. Rev. B **83**, 144502 (2011).