

## Parity-Violating Current-Voltage Curves in a Single Domain of $\text{Sr}_2\text{RuO}_4$ Superconductors

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We have found parity-violating current-voltage ( $I$ - $V$ ) curves in a single domain of spin-triplet  $\text{Sr}_2\text{RuO}_4$  below the superconducting transition temperature  $T_c$  [1]. In four-terminal measurements, the induced voltage  $V$  is generally an *odd* function of bias current  $I$  as observed for  $T > T_c$  of Fig. 1(b), which is a result of parity conservation. However, at  $T < T_c$ , we find that  $V$  is an *even* function of  $I$ . The anomalous  $I$ - $V$  curve means that positive voltage is detected regardless of the current direction and suggests the violation of parity. To understand the nature of the parity-violating  $I$ - $V$  curves, we consider a simple model of a vortex which has a helical internal structure characterized by a Hopf invariant (a topological invariant) [2]. We will also discuss that the hydrodynamics of such a helical vortex causes the parity violation to retain the topological invariant.

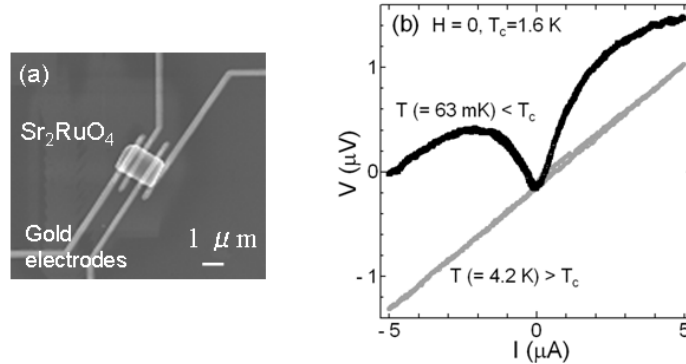


Figure 1: (a): A micrograph of a microscale  $\text{Sr}_2\text{RuO}_4$ . (b):  $V$  is plotted as a function of  $I$  at 63 mK and 4.2 K in the absence of magnetic field.

[1] H. Nobukane *et al.*, Solid State Communications (to be published), arxiv:0806.2201.

[2] E. Babaev, Phys. Rev. Lett. **88**, 17702 (2002)