Minicolloque MMPS21 **Oral (Invited)**

Tipping point of triplet pairing: Evidence for even parity unconventional superconductivity in Sr_2RuO_4

Andrej Pustogow[a]*

a. Institute of Solid State Physics, TU Wien, 1040 Vienna, Austria
* email: pustogow@ifp.tuwien.ac.at; website: https://www.ifp.tuwien.ac.at/forschung/pustogow-research

The physical picture of unconventional superconductivity (SC) in Sr_2RuO_4 has remained controversial since its discovery. While the system was considered a solid-state analogue to the superfluid ^{3}He-*A* phase for more than two decades [1,2], the broadly discussed chiral triplet scenario has been recently overturned [3]. However, other proposed triplet-pairing states are still viable. Establishing the condensate magnetic susceptibility is crucial as it reveals a sharp distinction between even parity (singlet) and odd parity (triplet) pairing [Fig. 1(a)], since the superconducting condensate is magnetically polarizable only in the latter case.

Here we use ^{17}O NMR spectroscopy to probe the nature of the SC state in Sr_2RuO_4 and its evolution with magnetic field. The Knight shift K, being sensitive to the spin polarization, is measured in the limit $T \rightarrow 0$ across the field-tuned transition down to $B/B_{c2} < 0.2$ [4]. While K includes contributions of both the field-induced quasiparticles (QP) and a possible spin polarization of the condensate (of order unity for a *p*-wave state), the specific heat C/T includes only the QP term. By comparing their field dependences [Fig. 1(b)], we find that the drop of K in the SC state coincides with the reduction of C/T – leaving no room for a finite condensate contribution. This way, we establish an upper bound for the condensate magnetic response of < 10% of the normal-state susceptibility, which is sufficient to exclude odd-parity candidates [4].

[1] *J. Phys. Condens. Matter* **7**, L643 (1995)
[2] *Nature* **396**, 658–660 (1998)
[3] *Nature* **574**, 72–75 (2019)
[4] arXiv:2007.13730

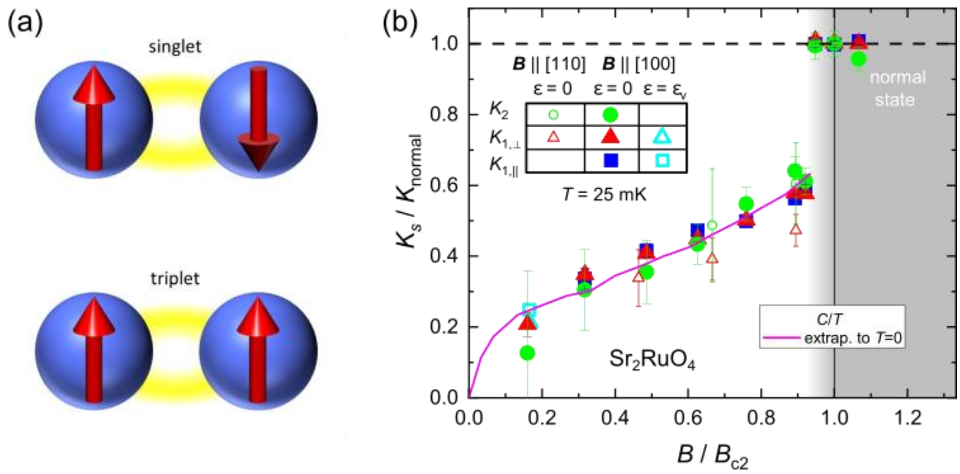

Figure 1: (a) While in most superconductors the Cooper pair spins form a singlet (top), Sr_2RuO_4 has been considered as a candidate for spin-triplet pairing (bottom) since the 1990's [1,2]. (b) Our detailed ^{17}O NMR studies [4] reveal that the drop of spin susceptibility (proportional to Knight shift K) coincides with the reduction of the specific heat C/T (magenta line) in the superconducting state, implying a condensate contribution indistinguishable from zero.