Minicolloque n° MMPS21 ■ **Oral** ☐ **Poster**

Orbital dichotomy of the Fermi liquid properties of Sr_2RuO_4 revealed by Raman spectroscopy

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Since the discovery of its superconducting state in 1994, Sr_2RuO_4 has attracted a lot of interest. Despite 25 years of experimental and theoretical results, its superconducting order parameter remains a puzzle [1], with no definitive result about its parity and the gap structure. Concomitantly the normal state has been investigated, and is now described as the prototype of a quasi-two-dimensional Fermi liquid. Studying its normal metallic state is interesting *per se*, but it also helps understanding the superconducting state which emerges from it.

I will present the experimental results we obtained from a thorough study of the electronic Raman response of Sr_2RuO_4 in its normal state above 7 K. Using a memory-function method [2], we extracted from the spectra the frequency dependent relaxation rate of the quasiparticles and their renormalized mass. The relaxation rate shows a quadratic frequency dependence at low temperature as expected for a Fermi liquid. By probing different symmetries of the Raman response, we could access different areas of the Brillouin zone. We find a significant symmetry dependence in the Fermi liquid properties. The quadratic prefactor of the scattering rate is approximately 3 times bigger in the B2g symmetry than in the B1g symmetry. This indicates a significant anisotropy of Fermi liquid properties which might be linked to orbital degrees of freedom. We also discuss our results with regard to the Gurzhi scaling law linking the temperature and frequency dependencies of the scattering rate for a Fermi liquid [3].

Beyond helping in understanding better the physics of Sr_2RuO_4, we hope that these results, obtained on a material which acts as the "drosophila" of Fermi liquids, will stimulate similar Raman studies on other Fermi liquid materials.

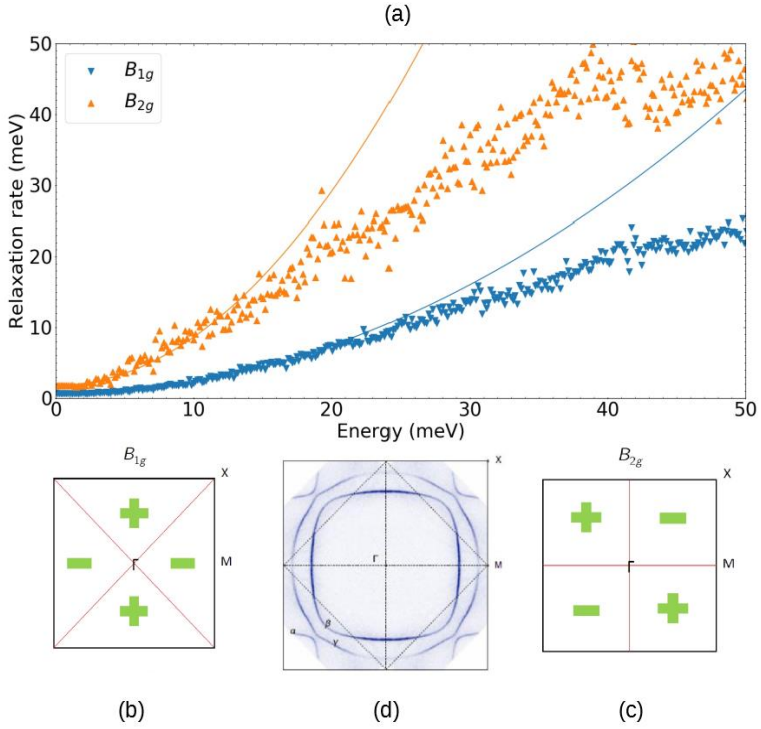

Figure:
(a) Quadratic fits of the frequency dependence of the relaxation rate in B1g and B2g symmetries at 5 K.
(b) and (c) Shape of the B1g and B2g Raman vertex in the Brillouin zone. The red lines denote nodal lines where the Raman scattering amplitude vanishes.
(d) Fermi surface of Sr_2RuO_4 (from [4]).

[1] A.P. Mackenzie et al., npj Quantum materials **2**, 40 (2017)
[2] M.Opel et al., Phys. Rev. B **61**, 9752 (2000)
[3] D. Stricker et al., Phys. Rev. Lett. **113**, 087404 (2014)
[4] A. Tamai et al. Phys. Rev. X **9**, 021048 (2019)