Laser ARPES measurements of Sr$_2$RuO$_4$ under uniaxial strain

Andrew Hunter$^1$, Carsten Putzke$^2$, Philip Moll$^2$, Anna Tamai$^1$ and Felix Baumberger$^{1,3}$

$^1$Department of Quantum Matter Physics, University of Geneva, Geneva, Switzerland
$^2$Laboratory of Quantum Materials (QMAT), Institute of Materials (IMX), Ecole Polytechnique Fédérale de Lausanne (EPFL), 1015 Lausanne, Switzerland
$^3$Swiss Light Source, Paul Scherrer Institute, Villigen, Switzerland

Author Email: andrew.hunter@unige.ch

Sr$_2$RuO$_4$ has evolved into a key model system for correlated electron physics following the discovery of its superconductivity - long believed to harbour p-wave triplet pairing - 28 years ago. The normal state of Sr$_2$RuO$_4$ is exceptionally well characterized and is generally regarded as the cleanest Fermi-liquid system amongst all transition metal oxides. Recent transport experiments discovered that a compressive strain of $\sim 0.6 \%$ causes the superconducting transition temperature of Sr$_2$RuO$_4$ to increase from 1.5 K to 3.4 K concomitant with the development of a pronounced non-Fermi-liquid behaviour in the normal state. This behaviour is commonly attributed to a Lifshitz transition in one of the three Fermi surface sheets [1–3].

Here, we report a new generation of ARPES experiments under strain based on a thermally actuated strain cell and a micro-structured tapered sample prepared with focused ion beam milling. Coupled with a micro-focused laser source, this allows the measurement of the quasi-continuous variation of strain on a single sample. We use this new capability to image the Lifshitz transition and to monitor the evolution of the quasiparticle dispersion and self-energy upon approaching the non-Fermi-liquid regime.

References