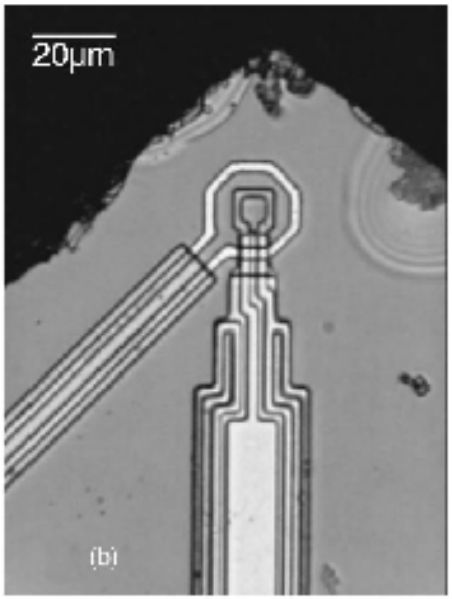
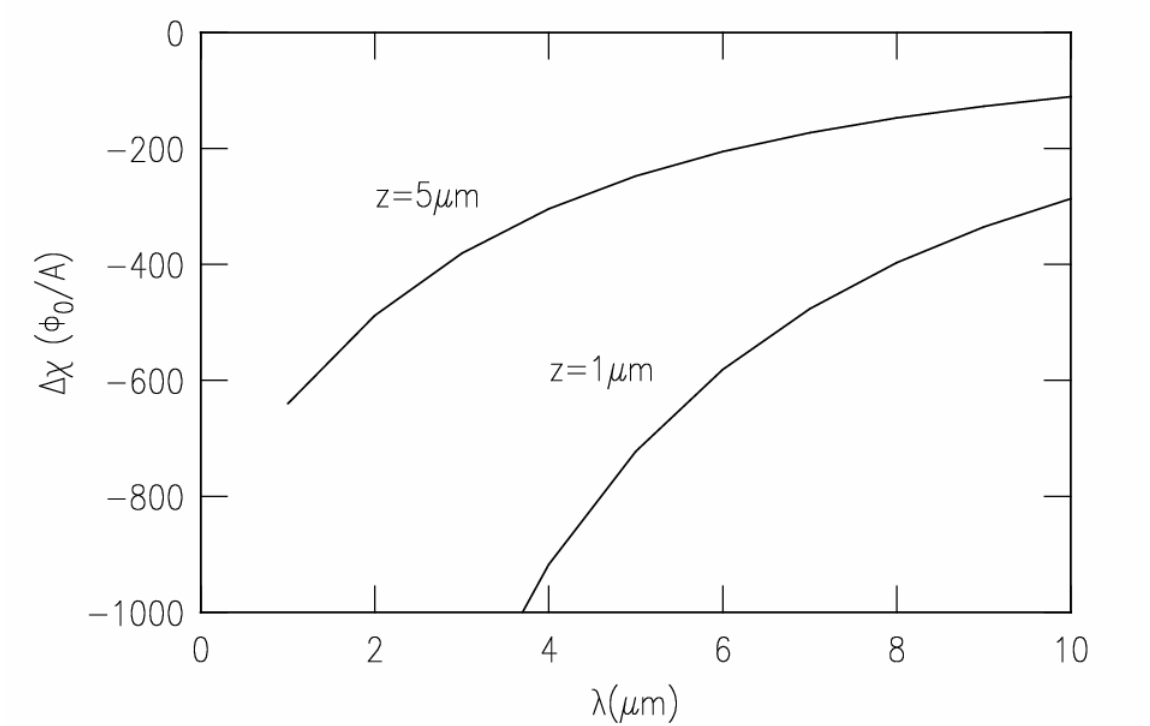
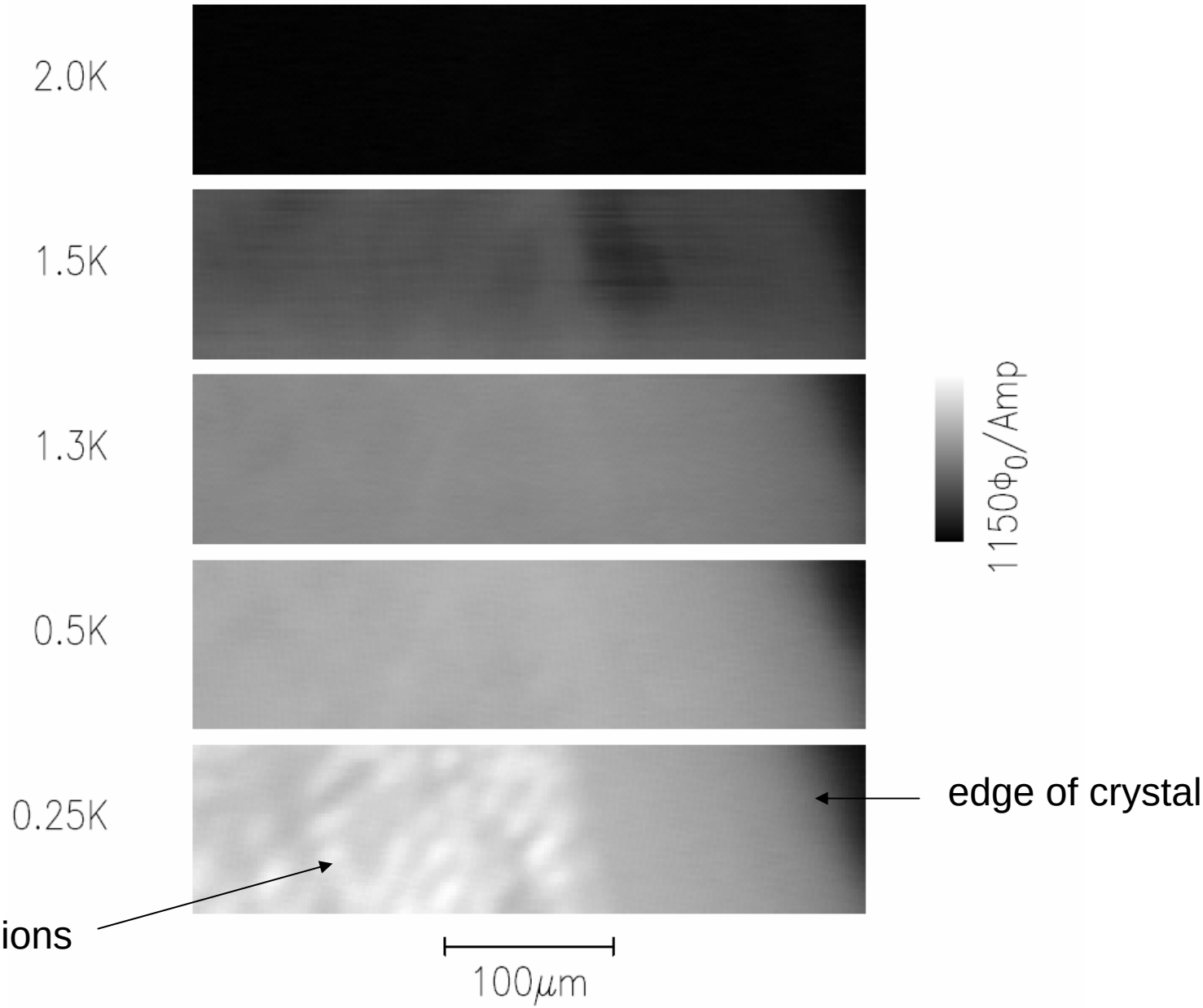
Scanning susceptometry measurements - local measure of superfluid density

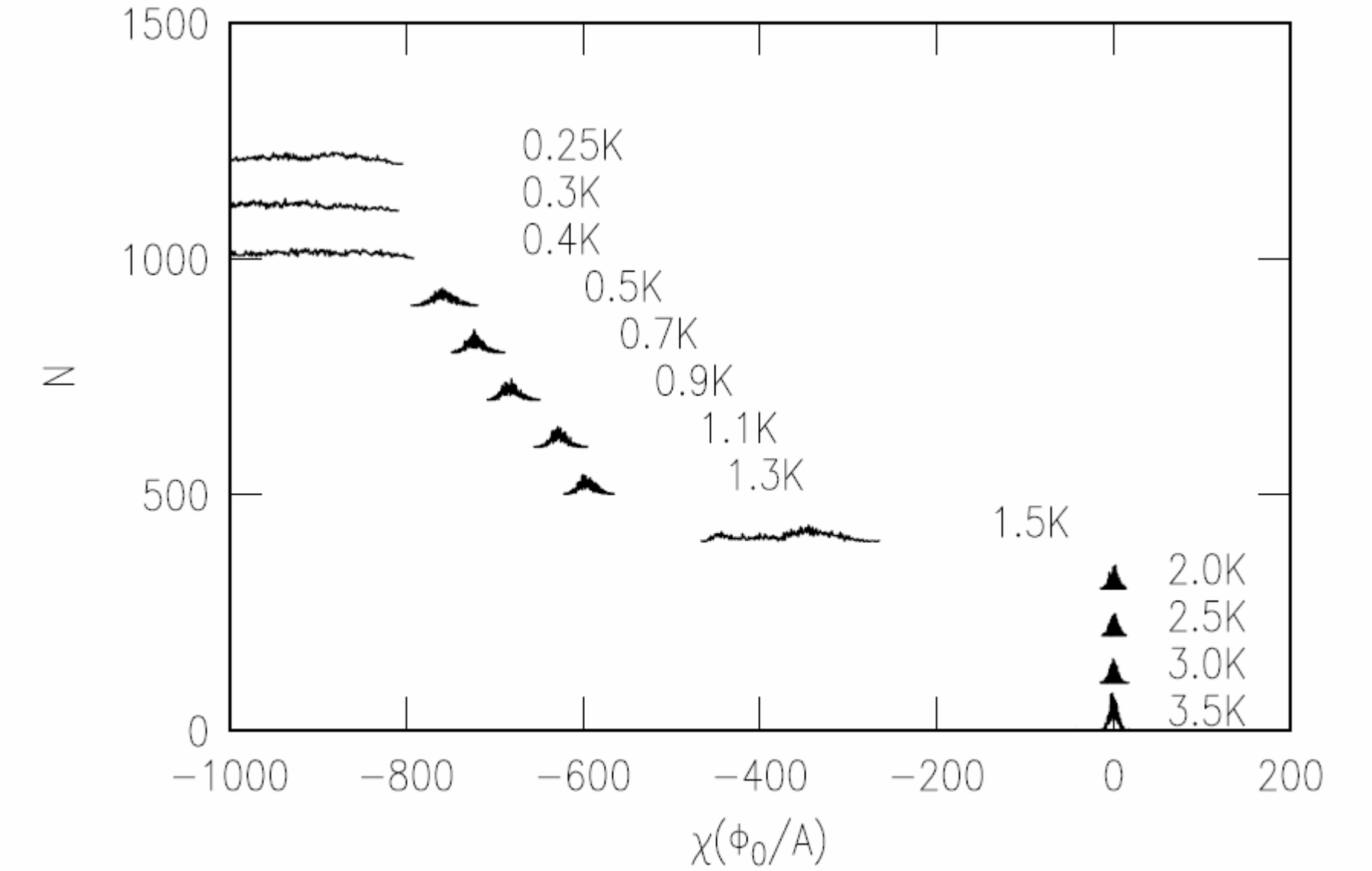


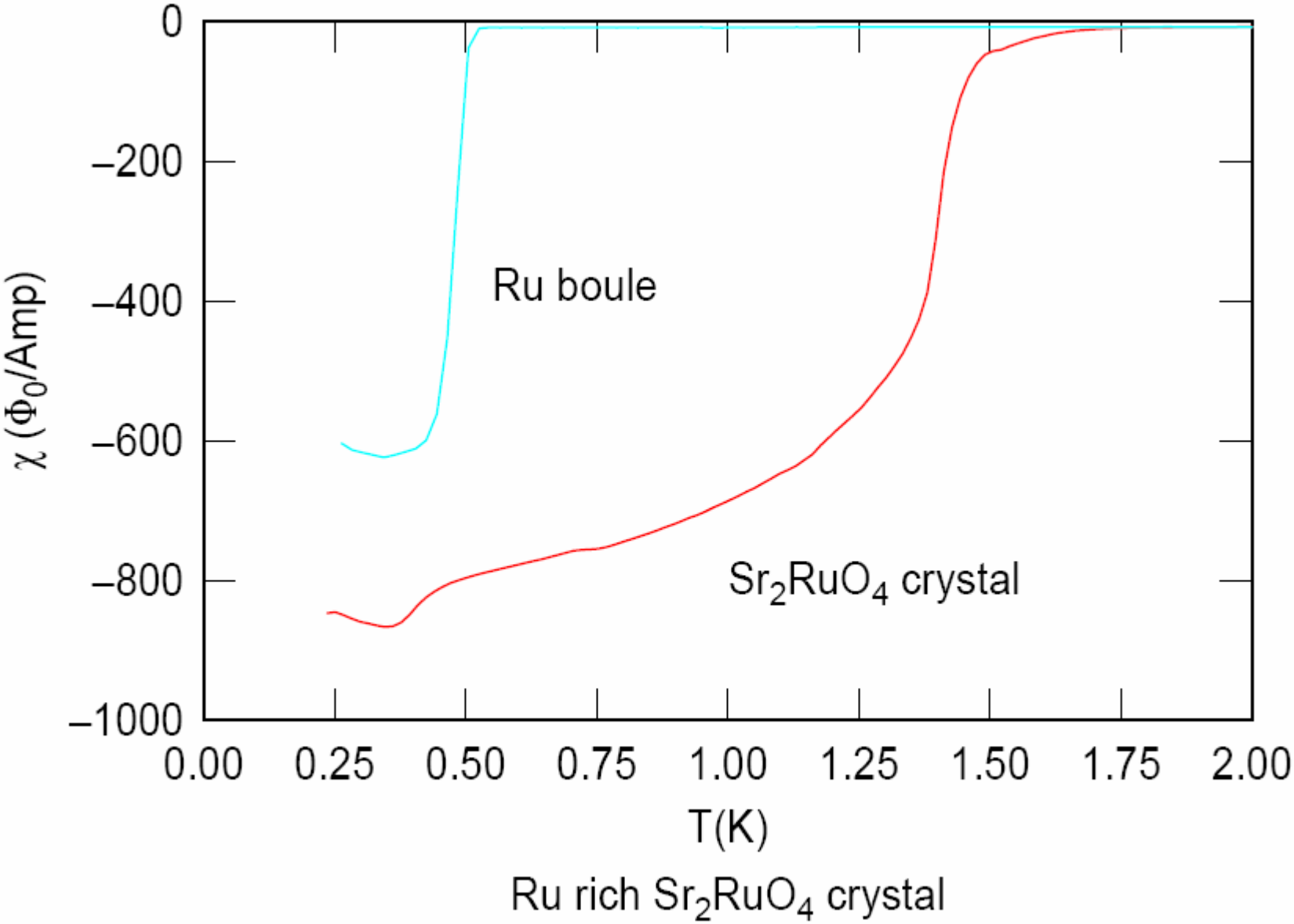


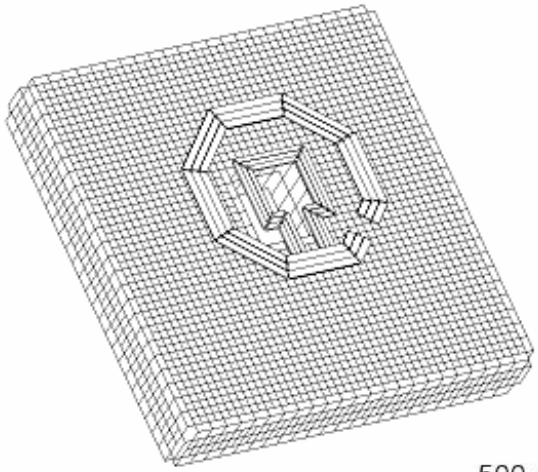
Susceptibility image - Ru rich Sr_2RuO_4 ac face



Histograms of susceptibility images

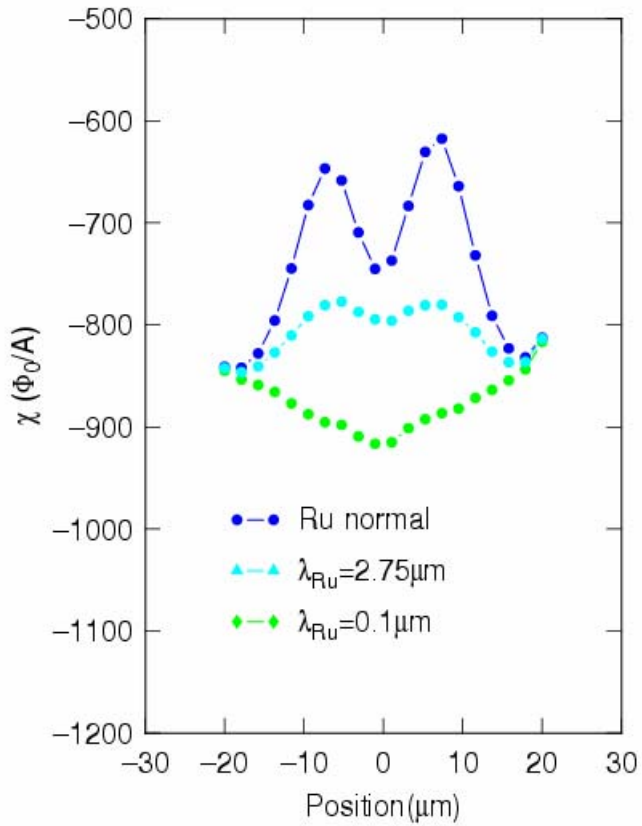



0
–200
–400
–600
–800
–1000
χ (Φ0/Amp)
Ru boule
Sr2RuO4 crystal
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
T(K)
Ru rich Sr2RuO4 crystal



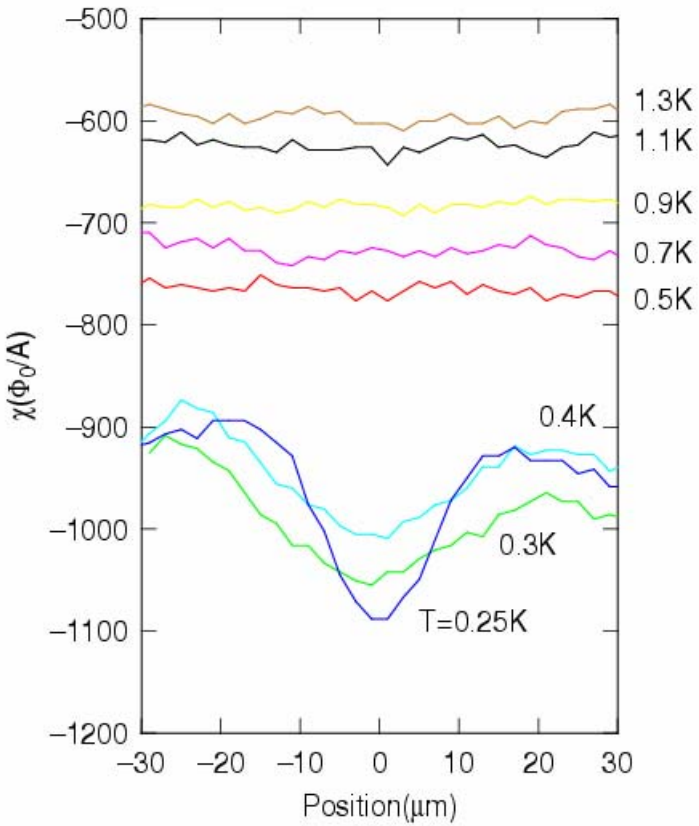
Fasthenry calculations

z=4μm 10μm×10μm hole



Model: 10μmx10μm Ru inclusion

λ_{bulk}=1.3μm



Experiment

Could this excess susceptibility come from $p_x \pm ip_y$ edge states?

$$L = N_{edge} m^* V R = \rho_{2d} \pi R^2 \hbar / 2 \qquad \rho_{2d} = k_F^2 / 2\pi$$

$$V = \hbar k_F / m^*$$

$$N_{edge} = k_F R / 4$$

$$I = \frac{N_{edge} e V}{2\pi R} \rightarrow \frac{N_{edge} e}{2\pi R}(V - e\vec{A}/m^*) \qquad \vec{A} = B_a r \hat{\theta}$$

$$\Delta I = \frac{k_F}{8\pi} \frac{e^2 B_a R}{m^*}$$

ΔI - edge state currents induced by applied field

$$\frac{\Delta\Phi}{\Phi_0 I_a} = \frac{\mu_0^2 k_F e^2}{32\pi m^* \Phi_0} \frac{R^3}{(R^2 + z^2)^{3/2}} \frac{R_s^2}{(R_s^2 + z^2)^{3/2}} A_{eff} \approx 10^{-3} / Amp - layer$$

$$N_{layers} \approx \lambda_c / d \approx 3\mu m / 1.3nm = 2400$$

$$\frac{\Delta\Phi}{\Phi_0 I_a} \approx 3 Amp^{-1}$$

compared with 100-200 Amp^{-1} from experiment - probably not