Supplemental Material to the article

“Helical magnetic ordering and anomalous electrical conductivity of $PdCrO_3$”

The integration in Eq. (12)

At low temperatures the umklapp processes give two contributions: between adjacent arcs (ρ_U^{ab}) and in the corner of the Brillouin zone (ρ_U^c) (see text). In the low temperature limit, the phonon wave vector is always close to the minimum value of $\mathbf{q}_0$.

1. Integration between the arcs:

$$\rho_U^{ab} \approx \frac{Aa|\mathbf{K}_{21}|^4 w^2(\mathbf{K}_{21})}{v_F^2 T} \int_a^b dl_1 \int_{-\infty}^{\infty} \exp\left(-\frac{\hbar u|\mathbf{q}|}{kT}\right) dl_2$$

where $|\mathbf{q}| \approx q_0 + \frac{l_2^2}{2q_0}$. After integration, we obtain

$$\rho_U^{ab} \approx \frac{\sqrt{2\pi q_0 k} Aa|\mathbf{K}_{21}|^4 w^2(\mathbf{K}_{21}) q_{ab}}{\sqrt{u\hbar} v_F^2} T^{-1/2} \exp\left(-\frac{\hbar u q_0}{kT}\right),$$

that coincides with Eq. (13).

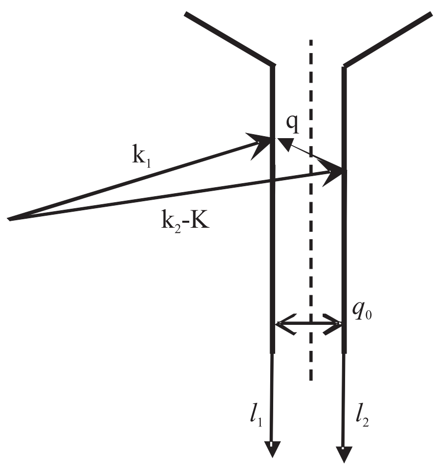

Fig. S1

2. Integration at the corner of the Brillouin zone:

$$\rho_U^c \approx 4\frac{Aa|\mathbf{K}_{21}|^4 w^2(\mathbf{K}_{21})}{v_F^2 T} I,$$

where

$$I = \int_0^{\infty}\int_0^{\infty} \exp\left(-\frac{|\mathbf{q}|}{t}\right) dl_2 dl_1, \quad |\mathbf{q}| \approx q_0 + \frac{\sqrt{3} l_2}{2} + \frac{l_1^2}{2q_0} + \frac{l_1 l_2}{2q_0} \quad \text{and} \quad t = \frac{kT}{\hbar u}.$$

A factor of 4 appears because for each angle there are 2 reciprocal lattice vectors $\mathbf{K}$, over which the summation takes place, and 2 arcs adjacent to the angle.

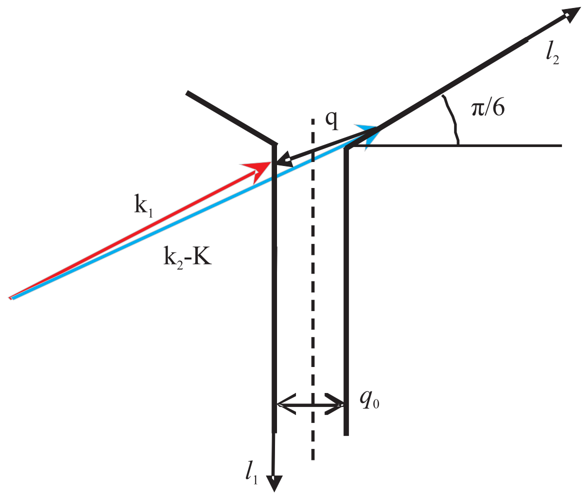

Fig. S2

Integrating over l_2 we get $I = \exp\left(-\frac{q_0}{t}\right) 2q_0 t \int\limits_0^\infty \frac{1}{\sqrt{3}q_0 + l_1} \exp\left(-\frac{l_1^2}{2q_0 t}\right) dl_1$. At $t \to 0$ and constant q_0 this expression is reduced to

$$I = \exp\left(-\frac{q_0}{t}\right) \frac{2t}{\sqrt{3}} \int\limits_0^\infty \exp\left(-\frac{l_1^2}{2q_0 t}\right) dl_1 = \sqrt{\frac{2\pi q_0}{3}} t^{3/2} \exp\left(-\frac{q_0}{t}\right).$$

Hence the conclusion follows: $\rho_U^c = \frac{4T}{\sqrt{3}\,T_{ab}} \rho_U^{ab}$, i.e. Eq. (14).