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Low-temperature specific heat and thermal Hall conductivity
in a vortex state of d-wave superconductors
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OSKAR VAFEK, Florida State University and National High Magnetic Field Laboratory — We analyze
the mixed state of d-wave lattice superconductors focusing on the quasiparticle
contribution to the specific heat and the thermal Hall conductivity at intermediate magnetic fields
$H_{c1} \ll H \ll H_{c2}$. In the ultra-low temperature regime
$T \ll T_0 \approx \frac{v_D^2}{(v_Fl)^2} = (T/v_Fl)\Phi[v_F/(Tl), v_F/v_D, k_Fl]$. In this regime the specific heat exhibits
oscillatory behavior as a $2\pi$-periodic function of $k_Fl$: in general it has an activated
form $C \propto \exp(-\Delta_m/T)$ except for a discrete set of $k_Fl$ where $\Delta_m = 0$ and $C \propto T^2$.
At temperatures $T_0 \ll T \ll \Delta$, the $k_Fl$-oscillations become unobservable due to thermal broadening and the Simon-Lee scaling is recovered. The results of the analysis
of the thermal Hall conductivity are similar: in particular, at the lowest temperatures, $\kappa_{xy}$ is an oscillating $2\pi$-periodic function of $k_Fl$. We calculate the scaling
functions numerically and compare our results with the existing experimental data
on the specific heat and thermal Hall conductivity.

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