

Anisotropic quasiparticle lifetimes in Fe-based superconductors

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In collaboration with

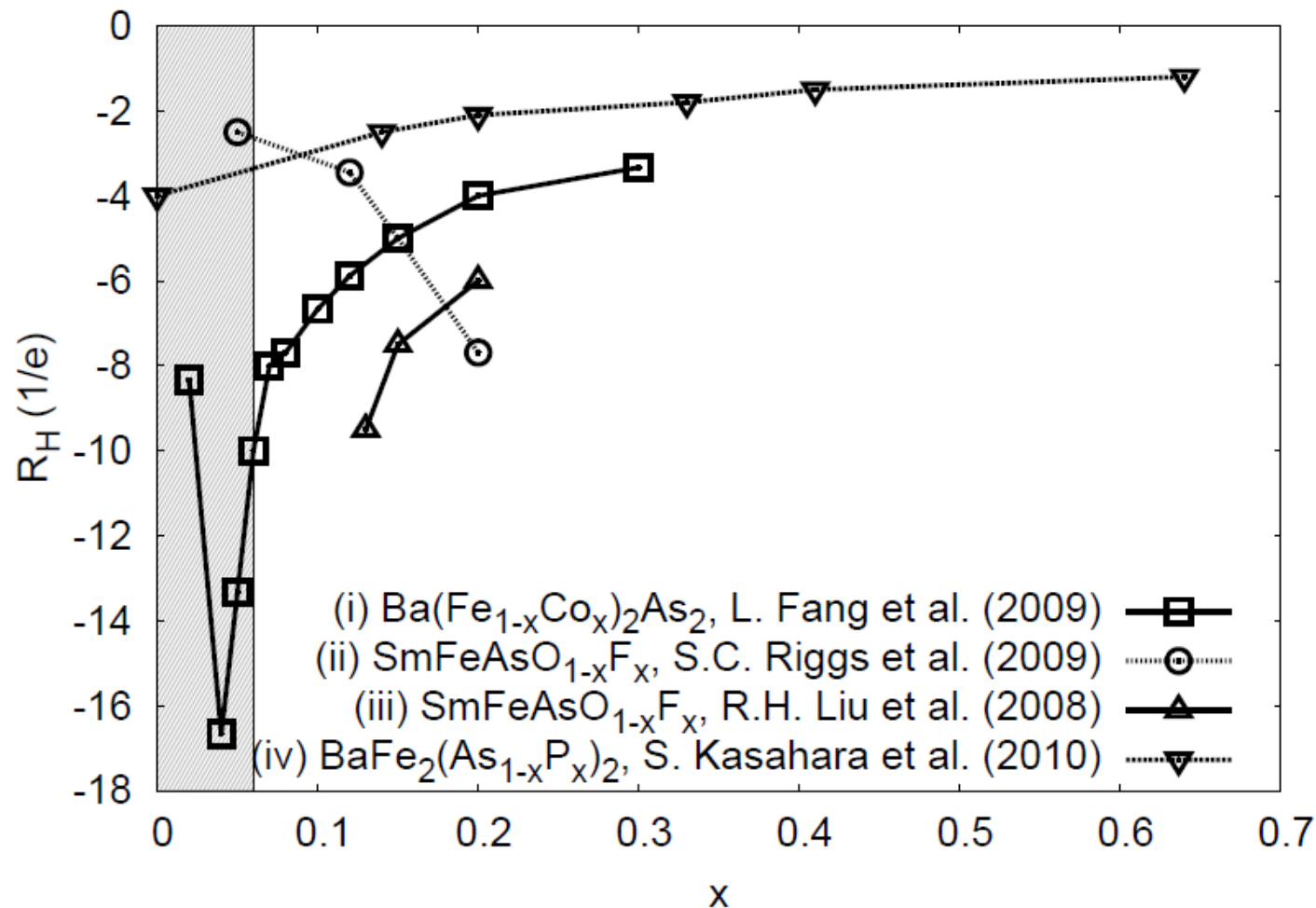
- Peter Hirschfeld
- Alexander Kemper (now in Stanford)
- James N. Fry
- Hai-Ping Cheng
- Thomas P. Devereaux (Stanford)



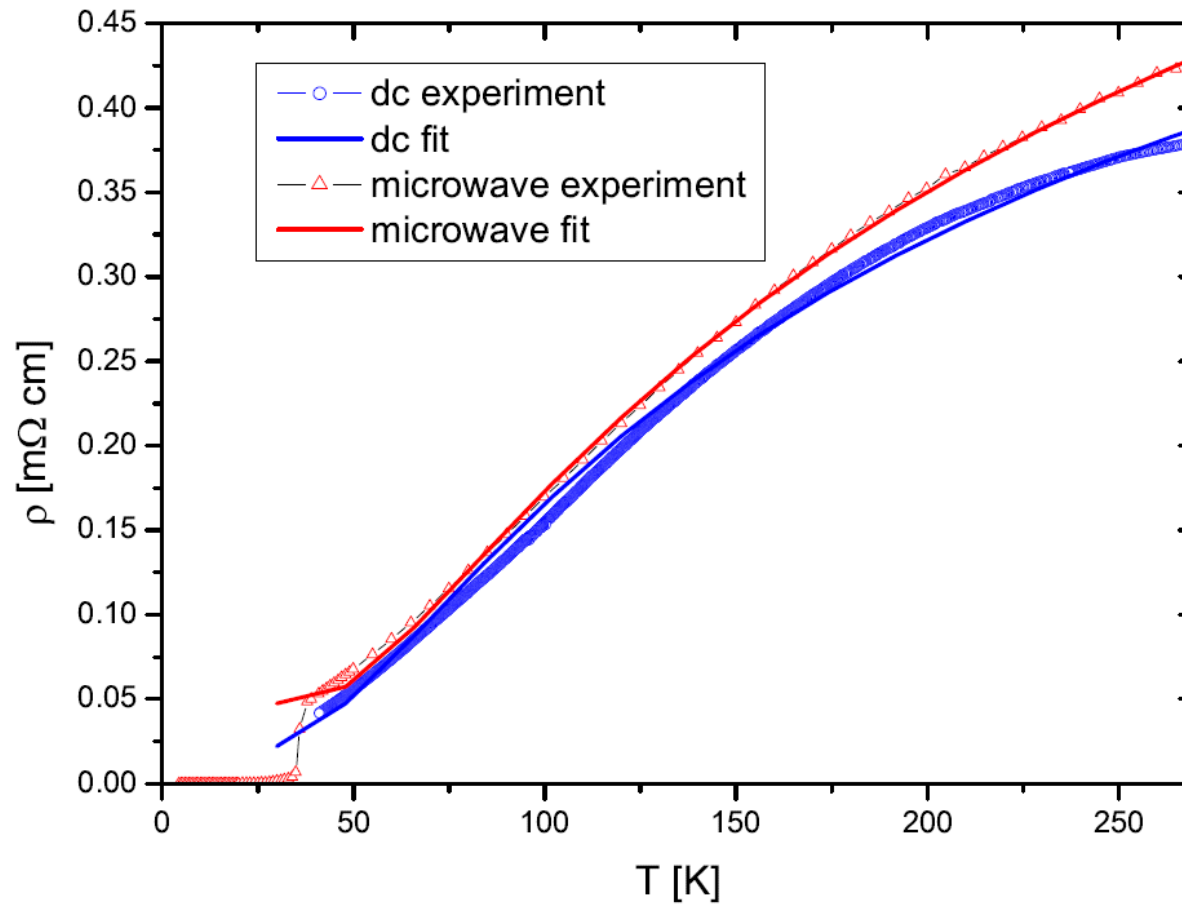
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[KITP, Iron-Based Superconductors-January-2011]

Hall coefficient

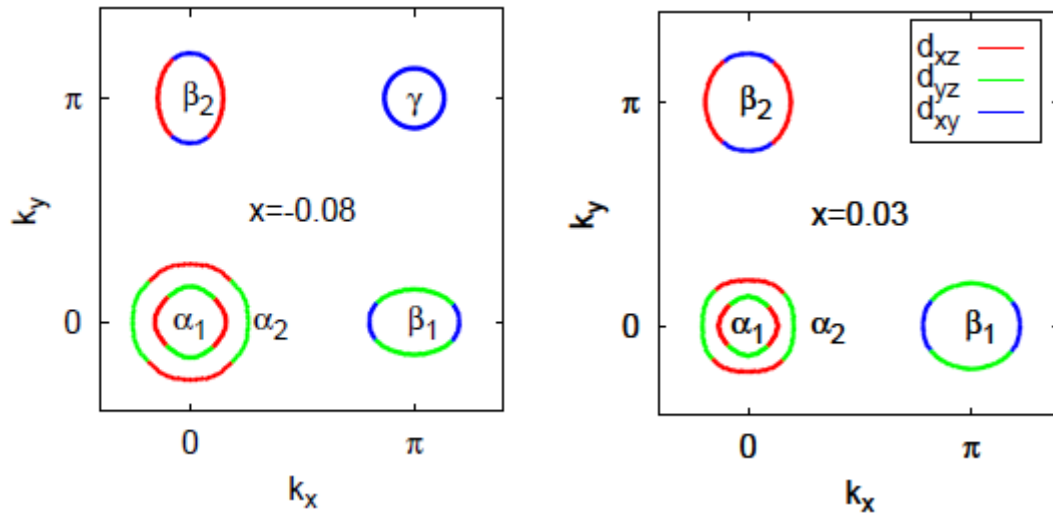


Resistivity in $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$



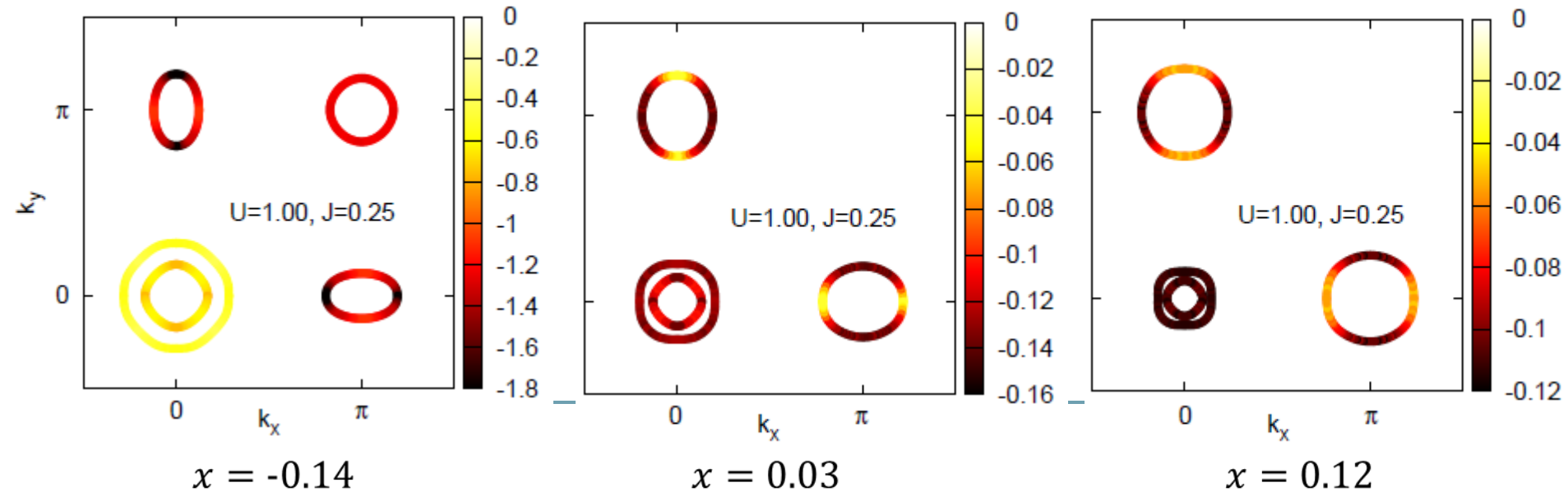
A.A. Golubov et al., arXiv:1011.1900

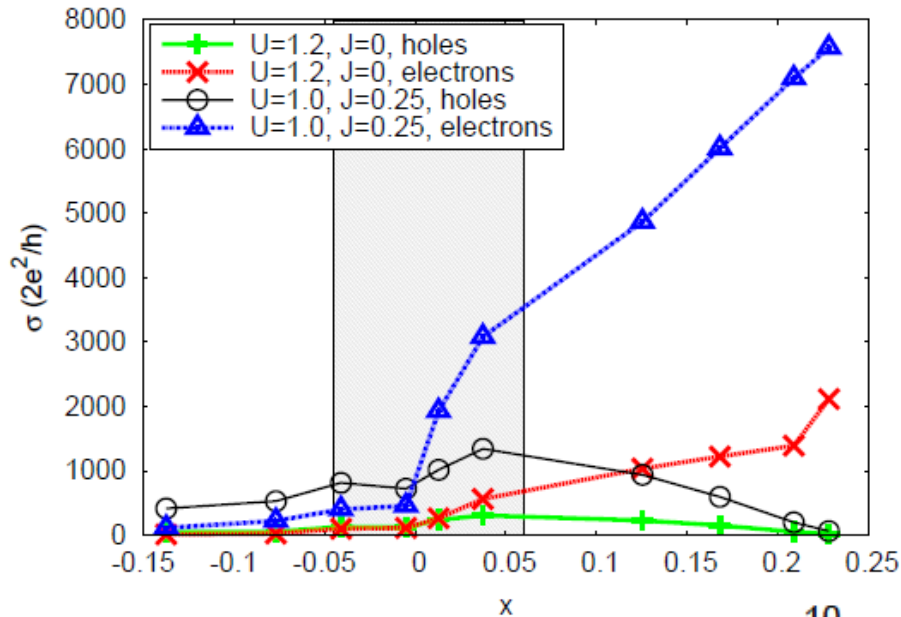
Electron-electron scattering



Fermi surface
orbital composition

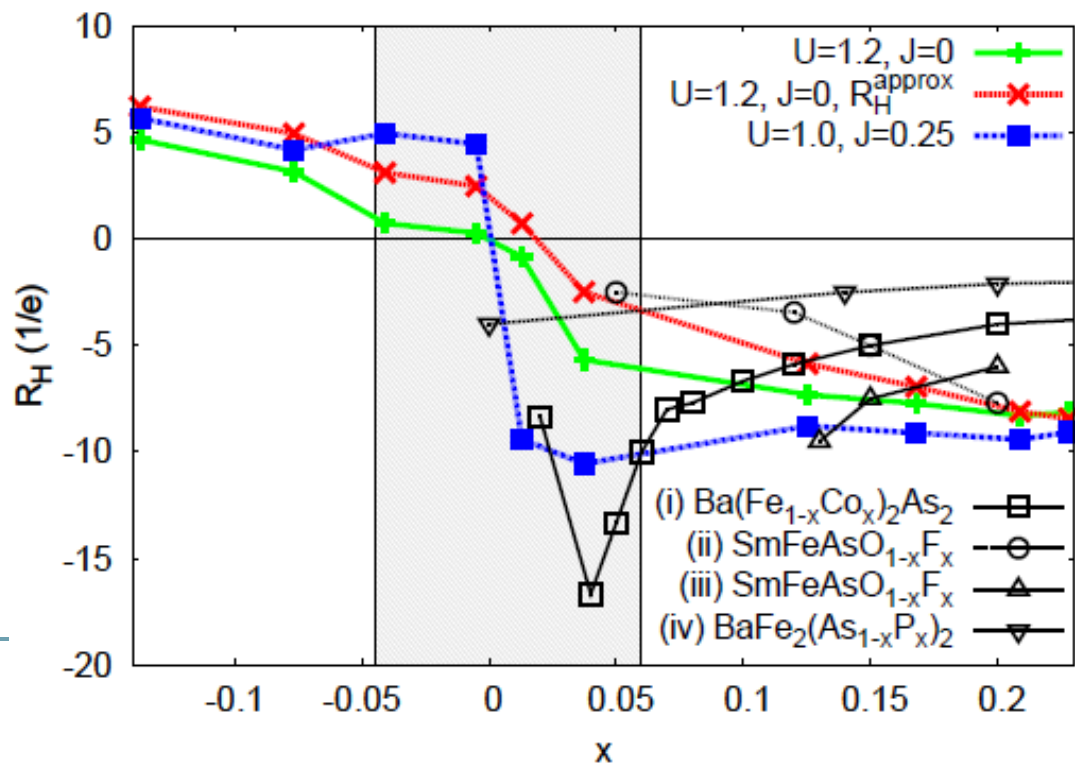
$\text{Im}\Sigma(\mathbf{k}, \omega=20 \text{ meV})$ [in meV]

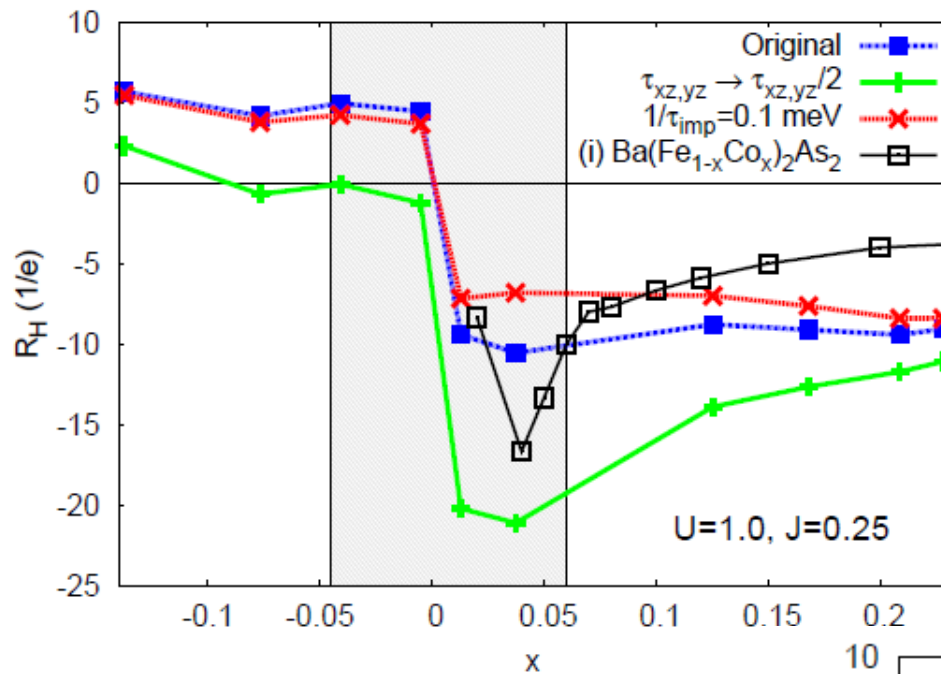




Conductivity,
Fermi velocity is important

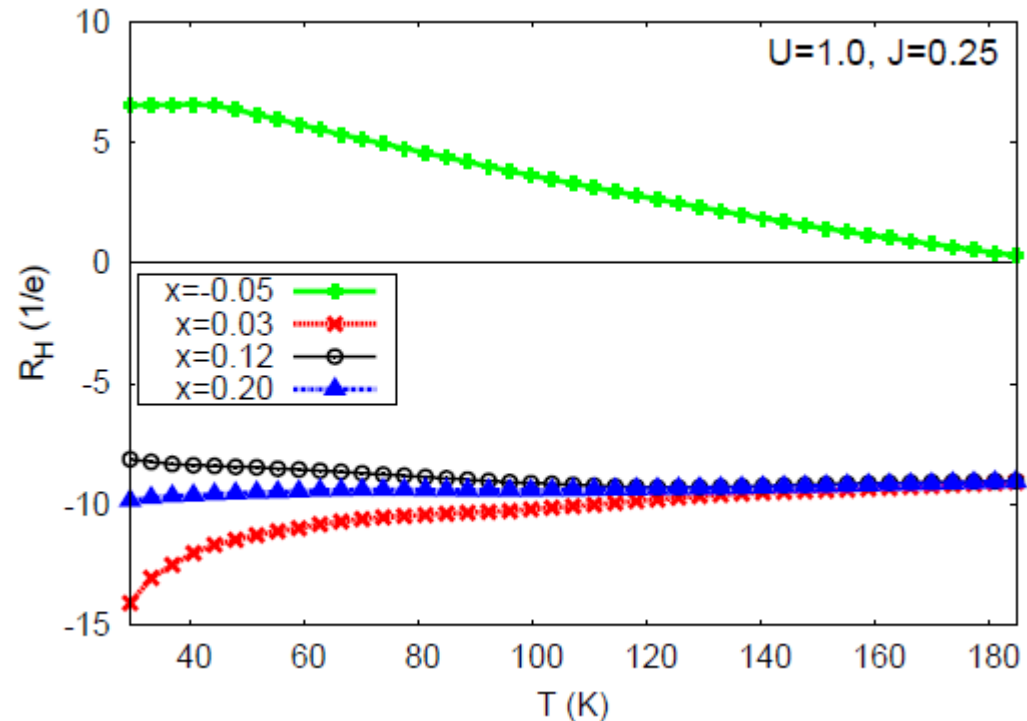
Hall coefficient,
Role of the mass anisotropy





1. Uniform impurities
2. Artificially increased anisotropy

Temperature dependence of the Hall coefficient:
 interband transitions at $x = 0.03$



Conclusions

- **Electron-electron interaction** → momentum-dependent scattering rate because of
 - **1. \mathbf{k} -dependent susceptibility**
 - **2. effective \mathbf{k} -dependence of the interactions due to orbital physics**
- **Highly anisotropic scattering on electron pockets** due to the orbital degrees of freedom
- **Several factors responsible for disparity between holes and electrons in transport (conductivity, Hall coefficient):**
 - **1. larger lifetime on parts of electron sheets**
 - **2. anisotropy of the Fermi velocity on electron pockets**
 - **3. anisotropic effective masses**
- **Elastic scattering on impurities do not provide pronounced anisotropy between hole and electron FS pockets**