# Longitudinal Field Muon Spin Rotation Study of Magnetic Freezing in Fe rich $FeSe_{0.25}Te_{0.75}$

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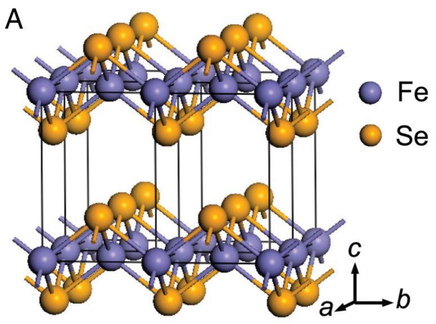
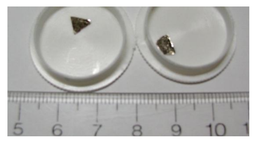
**Abstract -** We study the freezing of magnetic fluctuations in an Fe rich sample of the "11" iron-based superconductor using longitudinal field muon spin relaxation. The magnetic relaxation rate peaks at 15 K indicating spin glass freezing that nearly coincides with the superconducting transition of the corresponding Fe stoichiometric phase. At this temperature, the magnetic field dependence of the relaxation indicates slow magnetic fluctuations on the nanosecond timescale.

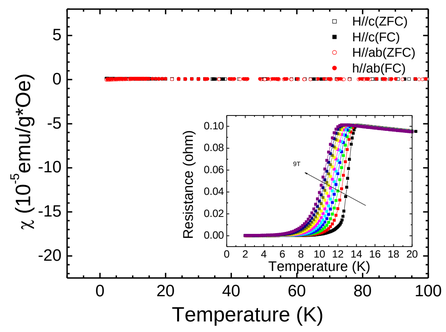



- Fe:Ch stoichiometry not necessarily 1
- Magnetic interstitial Fe
- To control Fe, must synthesize in absence of $O_2$

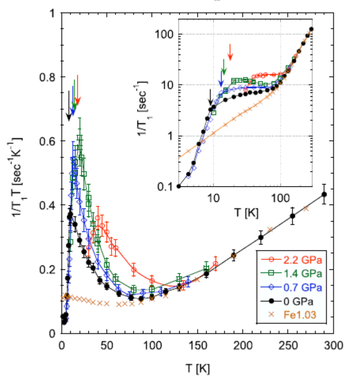
Excess Fe: superconductor becomes spin glass



## Squid and Resistivity

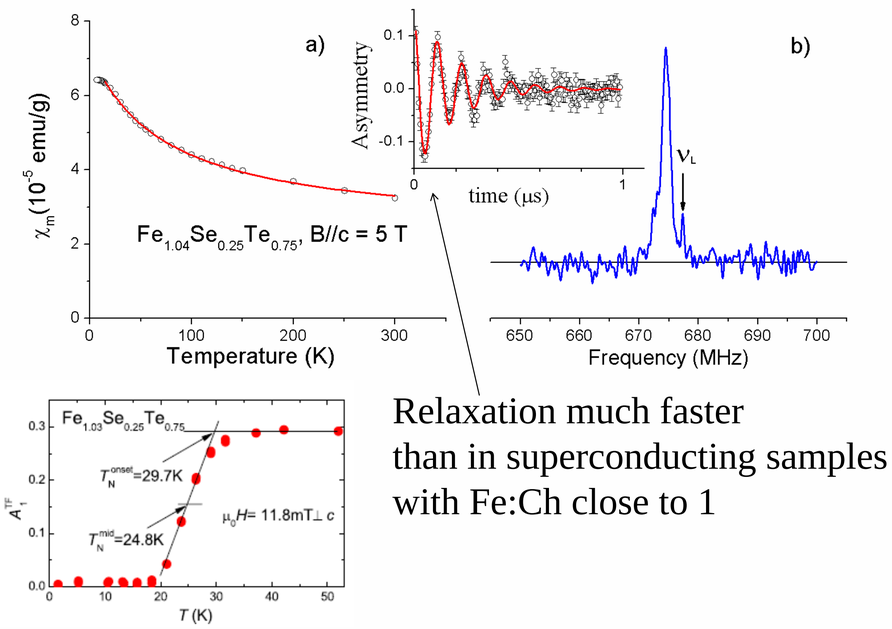



$^{77}$Se NMR in FeSe supercon.



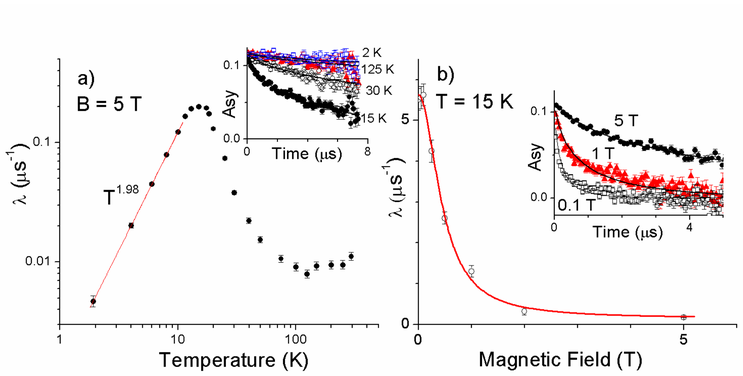

Imai et al., PRL 102, 177005 (2009)

Significant wipeout effect
Is this characteristic of the bulk?



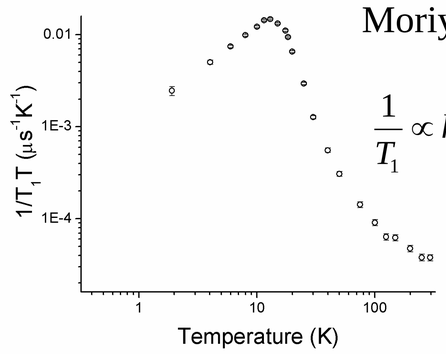

Khasanov et al, PHYSICAL REVIEW B **80**, 140511R 2009

Relaxation much faster
than in superconducting samples
with Fe:Ch close to 1



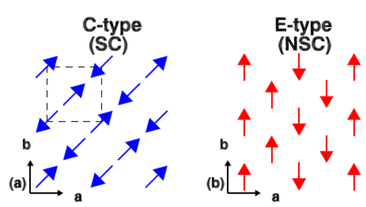

- High LF: magnetic relaxation
- Stretched Exponential with power = 0.625 throughout
- Peaks very close to superconducting Tc (coincidence?)
- Low T power law: $T^2$
- Field Dependence, Lorentzian + const

## Moriya Expression




$$\frac{1}{T_1} \propto kT \sum_{\vec{q}} A^2(\vec{q}) \frac{\chi''_{\perp}(\vec{q},\omega_0)}{\omega_0}$$

## Evolution of Magnetism with excess Fe




Neutron scattering: e.g. Z. Xu et al., Phys. Rev. B 82, 104525 (2010).

**Conclusions:**
Characterized magnetic transition in Fe rich nonsuperconducting $FeSe_{0.25}Te_{0.75}$