

# Pauli-Limited Behaviour in an iron-based Superconductor ? (2<sup>nd</sup> experiment)

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In May of 2014 at PSI, we performed a small angle neutron scattering experiment to measure the vortex lattice (VL) in clean  $\text{KFe}_2\text{As}_2$  crystals with the field-direction close to the basal a-b plane. But because of the failure of temperature control of the dilution, we could not finish all the measurements that we had expected and got backup beamtime in following October. Then I visited PSI again. The aim of the experiment is to confirm Pauli-limiting behaviour in an iron-based superconductor as described in the previous report.

First of all, good news was that we could use a vertical tilt function that was not available in the last experiment in May with a newly installed sample table. Fig.1 shows VL patterns observed under the conditions mentioned in each figures. All the data were obtained by rocking though the Bragg condition by the tilt function. It is clear that the tilt function is inevitable to improve the experimental data.

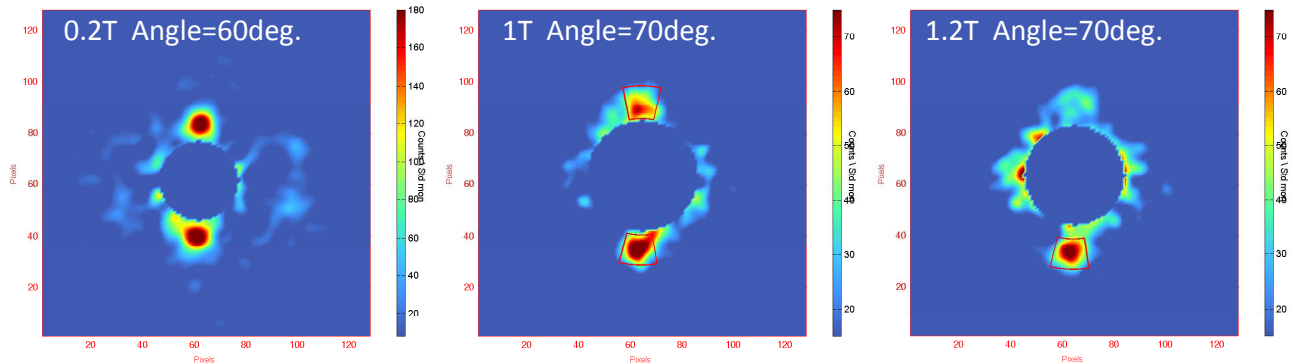


Fig.1 VL scattering pattern in  $\text{KFe}_2\text{As}_2$ . Temperature was 0.04 K for all data.

From these measurements, however, we could not confirm the Pauli-limiting behaviour. Namely we found that the magnetic form factor of the VL decreases with the field and no constant and increasing behaviours were detected at least at the field angle up to 70deg. But this kind of behaviour is expected to appear in a really narrow region of the angle. We would like to extend the measurement toward the higher angle region, where the scattering intensity becomes much lower. In addition, to confirm Pauli-limiting behaviour in an iron-based superconductor, we submitted a new proposal to ILL, in which we aim to detect Q phase behaviour.

Finally, it should be noted that this travel was done with a financial support of by ISSP. We appreciate it pretty much since it could not be done without it.