Interplay Between Metamagnetism and the Upper-critical Field in SmFeAsO$_{0.9}$F$_{0.1}$

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Introduction
The recent discovery of superconductivity at $T_c = 26$ K in iron-based LaO$_{1-x}$F$_x$FeAs ($x = 0.05–0.12$) [1] has attracted great attention. Following this initial work, more compounds with $T_c$ as high as 55 K were synthesized by replacing La with other rare-earth elements such as Sm [2–4].

Experimental
We performed micropiezolever based torque magnetometry in small single crystals of SmFeAsO$_{0.9}$F$_{0.1}$ in conjunction with a $^3$He system and the hybrid magnet, with the initial intention of exploring the superconducting phase diagram of this compound at high magnetic fields.

Results and Discussion
Figure 1 shows a summary of our results as a function of temperature, field and angle indicating the emergence of a very sharp and hysteretic transition in close proximity to the superconducting upper critical field of this compound.

Conclusions
It is thus possible that the actual magnetic state of the Ln-O layer might affect the superconductivity in the FeAs layers, i.e. the metamagnetic transition may induce a magnetoelastic effect such that the Fe-As bond angle changes significantly to the point of suppressing superconductivity. Notice that our preliminary measurements in pulsed fields, indicate a very small jump in the magnetic moment at the transition (0.05 $\mu_B$) which would not account for the apparent suppression of superconductivity.

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References