

# Magnetic neutron diffraction study on antiferromagnetic order in highly H-doped LaFeAsO

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Iron pnictides comprise a new class of high-temperature (high- $T_c$ ) superconductors, in which magnetic correlations are regarded to play an important role for its Cooper-pairing formation, as in high- $T_c$  cuprates. The second superconducting dome (SC2) observed in the hydrogen-doped iron pnictide LaFeAsO<sub>1-x</sub>H<sub>x</sub> with  $0.2 \leq x \leq 0.4$  is intriguing because no such the feature appears in high- $T_c$  cuprates. In order to understand the interplay between the superconductivity and magnetism, magnetic correlations of LaFeAsO<sub>1-x</sub>H<sub>x</sub> were explored by neutron diffraction at beyond the SC2. Eventually, we directly found an antiferromagnetic long-range-ordered state. Further, the magnetic structure of  $x = 0.51$  was determined, which is different from those of other parent antiferromagnets (Table 1). We will discuss the compound of  $x = 0.51$  as a possible parent antiferromagnet.

Table 1. Magnetic structure parameters for parent antiferromagnetic compounds in Fe-based superconductor systems.

Material	$\mathbf{Q}_T$	$\mathbf{m}$	Fe moment	Reference
LaFeAsO	[1/2, 1/2, 1/2]	$\mathbf{m} // \mathbf{Q}_{T,ab}$	0.63 $\mu_B$	Qureshi (09)
PrFeAsO	[1/2, 1/2, 0]	"	0.48 $\mu_B$	Zhao (08)
NdFeAsO	[1/2, 1/2, 1/2]	"	0.25 $\mu_B$	Chen (08)
CaFe <sub>2</sub> As <sub>2</sub>	[1/2, 1/2, 1]	"	0.8 $\mu_B$	Goldman (08)
BaFe <sub>2</sub> As <sub>2</sub>	[1/2, 1/2, 1]	"	0.87 $\mu_B$	Huang (08)
Fe <sub>1.068</sub> Te	[1/2, 0, 1/2]	$\mathbf{m} \perp \mathbf{Q}_{T,ab}$	2.25 $\mu_B$	Li (09)
LaFeAsO <sub>0.49</sub> H <sub>0.51</sub>	[1/2, 1/2, 0]	$\mathbf{m} \perp \mathbf{Q}_T$	1.2 $\mu_B$	Present work

## References

- [1] M. Hiraishi *et al.*, Nature Phys. **10**, 300 (2014).
- [2] S. Iimura *et al.*, Nature Commun. **3**, 943 (2012).