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Magnetic dopants and spin-density waves: the $SmFe_{1-x}Mn_xAsO$ case

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Electronic correlations play a key role in tuning the properties of parent- and doped (superconducting) iron pnictides, ultimately determining their respective ground states. Parent compounds with magnetic doping are particularly intriguing, since dopant coupling via Ruderman-Kittel-Kasuya-Yosida (RKKY) interactions depends significantly on the strength of electronic correlations, which interact with the underlying SDW phase.

Here, we address the interesting case of Fe-to-Mn substitution in the SmFeAsO parent compound [1] through comparative studies of $SmFe_{1-x}Mn_xAsO$, with x(Mn) = 0.05 and 0.10, via dc-magnetization, Hall-effect, and muon-spin spectroscopy measurements. Our main experimental findings are: (i) the Fe-to-Mn substitution weakens the commensurate spin-density wave (SDW) order of iron, whose transition temperature decreases with increasing Mn content. (ii) At low temperature, well inside the SDW ordered phase, an additional magnetic order sets in at $T^* \sim 10$ K and 20 K, for x = 0.05 and 0.10, respectively. We demonstrate that diluted Mn ions can pin the electronic charges and thus induce a radical reconstruction of the Fermi surface, in turn responsible for a commensurate-to-incommensurate antiferromagnetic (AF) transition at T^*.

[1] M. Meinero, P. Bonfà, I. J. Onuorah, S. Sanna, R. De Renzi, I. Eremin, M. A. Müller, J.-C. Orain, A. Martinelli, A. Provino, P. Manfrinetti, M. Putti, T. Shiroka and G. Lamura, *Scientific Reports* **11**, 14373 (2021), https://doi.org/10.1038/s41598-021-93625-7.

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