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Universal stripe order as a precursor of the superconducting phase in BaFe2Se3 Spin Ladder

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In the last years, superconductivity has been observed in a couple of iron based one dimensional compounds, $BaFe_3X_3$ X=S,Se. Indeed, for both compounds, a pressure induced superconducting dome develops above 10 GPa and below 14 K. A significant difference between the two systems is their magnetic ground state at low pressure. The magnetic order of $BaFe_3Se_3$ takes the form of staggered ferromagnetic blocs along the ladder [6], while for $BaFe_3Se_3$ a conventional antiferromagnetic order is formed along the ladder. These different magnetic symmetries raise the question of the role of magnetism in the mechanism leading to superconductivity. One would indeed expect a similar magnetic order for both compounds allowing a common and universal mechanism.
Our recent neutron scattering results on the compounds $BaFe_3Se_3$ revealed a new picture of the magnetic properties from ambient pressure up to the superconducting critical pressure [[1],2]. Using single crystal and powder neutron diffraction on $BaFe_3Se_3$, we refined the magnetic structure at ambient pressure and discovered a new magnetic order similar to the $BaFe_3S_3$ stripe phase near the superconducting dome. This magnetic phase thus appear to be universal for this family, giving a strong indication of its role in the origin of superconductivity.
[[1]] W. Zheng, V. Balédent et al. Nature Communication Physics 5, 183 (2022)
[2] W. G. Zheng, V. Balédent et al. Accepted in Physical Review B (2022)

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