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## Investigations of the Antiferromagnetic Order Parameter in Nano-Sized YBCO Particles

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YBCO ( $\text{YBa}_2\text{Cu}_3\text{O}_{6+x}$ ) is maybe the best known high-temperature superconductor (HTSC), being the first superconductor with a TC above the boiling point of liquid N<sub>2</sub>. It is as the other cuprate HTSC antiferromagnetically ordered at low doping, and a superconductor at high doping. The superconductivity of YBCO is a two-dimensional phenomenon, existing even in materials only one unit cell high. However, it is well known that the dimensionality of the system affects the magnetic order in a material, with for instance a changed magnetization curve.

We have manufactured disc-shaped YBCO with a diameter of 30nm and a height of 3nm, and using neutron diffraction (ND) and muon spin rotation ( $\mu\text{SR}$ ) we have measured the staggered magnetization in the YBCO particles versus doping and temperature.

The results show a significant lowering of both the Néel temperature and of the staggered magnetic order parameter compared to bulk. This shows that the magnetic order parameter in YBCO is a 3D phenomenon, in opposition to the superconducting order parameter. Furthermore the  $\mu\text{SR}$  results show the reentry of the magnetic order parameter at low temperature, previously only reported in bulk-sized systems. This observation strongly supports the view that the reentry is an intrinsic property of the cuprate systems.