Hidden Magnetic Texture in the Pseudogap Phase of the High-Tc $YBa_2Cu_3O_{6+x}$

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The origin of the enigmatic pseudogap phase of high-Tc superconducting cuprates remains an unsolved mystery. Over the last decades, polarized neutron diffraction (PND) revealed that the pseudogap state hosts an intra-unit cell (or q=0) magnetism preserving the lattice translational (LT) symmetry and breaking the time-reversal and parity symmetries [1]. This q=0 magnetism is interpreted in terms of loop current (LC) patterns accompanied by anapoles [1].

Our PND measurements in $YBa_2Cu_3O_{6+x}$ with different hole doping levels [2-4] uncover a novel hidden magnetism that may be crucial to elucidate the pseudogap puzzle. This short-range magnetism is carried by the CuO_2 layers and settles in at T*, the pseudogap onset temperature. Distinct from the q=0 magnetism, the related magnetic signal appears at the planar wavevectors q=(0.5,0) and (0,0.5), yielding a (2x2) quadrupling of the magnetic unit cell within the [a,b] plane (q=½ magnetism). The associated magnetic moment is predominantly pointing perpendicular to the CuO_2 planes, consistent with the LC picture. Finally, the q=½ magnetism vanishes in the overdoped regime, following the doping dependence of the pseudogap [3].

The q=0 and q=½ magnetisms could be embedded within a single spread-out magnetic texture of LCs. Such a magnetic texture could be consistent with the theoretical proposal of LC supercells, breaking the LT and able to reconstruct the Fermi surface [5]. The existence of such broad entities reveals an unexpected aspect of the pseudogap physics, bringing new pieces to the puzzle of this enigmatic state of matter.

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