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Novel magnetic excitations in the high-temperature superconductor $HgBa_2CuO_{4+\delta}$ MUN CHAN, University of Minnesota, YUAN LI, Max Planck Institute for Solid State Research, Germany, V. BALÈDENT, Laboratoire Lèon Brillouin, N. BARIŠIĆ, University of Minnesota, K. HRADIL, Forschungsneutronenquelle Heinz Maier-Leibnitz, Germany, YANGMU LI, University of Minnesota, R.A. MOLE, Forschungsneutronenquelle Heinz Maier-Leibnitz, Germany, Y. SIDIS, Laboratoire Lèon Brillouin, P. STEFFENS, Institut Laue Langevin, France, G. YU, University of Minnesota, X. ZHAO, Jilin University, China, P. BOURGES, Laboratoire Lèon Brillouin, M. GREVEN, University of Minnesota — We report on the observation of novel magnetic excitations in the pseudogap phase of the cuprate superconductor $HgBa_2CuO_{4+\delta}$ (Hg1201) using neutron scattering, and on their relationship with antiferromagnetic (AF) fluctuations. Following polarized neutron diffraction experiments that demonstrated a novel (q=0) magnetic order in the pseudogap phase [B. Fauqué *et al.* PRL 96, 197001 (2006); Y. Li *et al.*, Nature 455, 372 (2008)], our inelastic measurements revealed two weakly-dispersive magnetic excitation branches in Hg1201 [Y. Li *et al.*, Nature 468, 283 (2010), and preprint]. These excitations are observed in the pseudogap phase and appear to be associated with the q=0 magnetic order. In our optimally-doped sample, the magnetic resonance occurs at the dispersion maximum of the higher-energy branch. In under-doped Hg1201, the two excitation branches exhibit local intensity maxima at q_{AF}, and we find evidence for an hourglass dispersion associated with the lower branch. These results reveal a profound connection between the novel excitations and the conventional AF fluctuations.

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