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Collective Modes in Cuprates and their coupling to Fermions

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The quantum-critical fluctuations of the loop current order observed universally in underdoped Cuprates have been derived and shown to be local in space and power law in time. The coupling of these fluctuations to fermions are shown to promote d-wave pairing as well as to give the Marginal Fermi liquid single particle spectra in the normal state [1]. Three collective fluctuations modes in the loop order modes are derived [2]. They are massive weakly dispersive magnetic modes. Two of these branches have been discovered. Experiments are suggested to discover the third branch.

[1] V. Aji, A. Shekhter and C.M. Varma, Phys. Rev. B. 81, 06451 (2010).
[2] Yan He and C.M. Varma, arXiv:1008.3182.