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Theory of quasiparticle excitations in cuprates: universal Fermi velocity and high energy anomalies[1] QIANG-HUA WANG, Nanjing University — Recent measurements of quasiparticles in hole-doped cuprates reveal highly unusual features: 1) the doping-independent Fermi velocity, 2) two energy scales in the quasiparticle spectral function, and 3) a suppression of the low energy spectral weight near the zone center. The underlying mechanism is under hot debate. We addressed these important issues by a new mean field theory and a novel variational Monte Carlo (VMC) study of the t- J model. We obtained results in both approaches in agreement with the experiments but without invoking extrinsic effects. They reflect the role of strong correlations in the form of local Mottness and antiferromagnetic fluctuations, yielding a strong connection between the low and high energy quasiparticle excitations. Besides, we resolved a long standing issue of the sum rule for quasiparticle spectral weights in traditional VMC studies. The electron doped case was also discussed and we concluded that no high energy anomaly exists in the occupied side, in contrast to the hole doped case.

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