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Evolution of hourglass like magnetic excitation in underdoped $La_{1.90}Sr_{0.10}CuO_4$. MAIKO KOFU, Univ. of Virginia, TETSUYA YOKOO, KEK, KAZUYOSHI YAMADA, Tohoku Univ., FRANS TROUW, LANL — Recent neutron scattering studies have revealed similar "hourglass-lik" magnetic excitations in mono-layered $La_{1.875}Ba_{0.125}CuO_4$ and bi-layered $YBa_2Cu_3O_{6.6}$. These results indicate that such hourglass-like dispersive excitations might be common to high-T_c cuprates. To elucidate the interplay between the excitation and the superconductivity, we investigated the hole doping dependence of excitations. We performed inelastic neutron experiments for underdoped $La_{1.90}Sr_{0.10}CuO_4$(T_c=29K) using chopper spectrometer PHAROS installed at Los Alamos National Laboratory. Clear four incommensurate peaks were observed at ω=8meV and the incommensurability corresponds to $\sim$0.1 r.l.u., which is consistent with previous study. Around ω=30meV, a single peak was observed at the antiferromagnetic magnetic zone center. This indicates that the hourglass-like excitations also exist in underdoped $La_{1.90}Sr_{0.10}CuO_4$ and that the saddle point becomes $\sim$30meV. For optimally doped $La_{1.84}Sr_{0.16}CuO_4$(T_c =38K), the saddle point is expected to correspond to 40meV or more, suggesting that the saddle point goes up with increasing hole doping. Moreover, we found that the slope of dispersion is almost same for $La_{1.90}Sr_{0.10}CuO_4$ and $La_{1.84}Sr_{0.16}CuO_4$. The reduction of energy at saddle point is recognized as a consequence of difference of incommensurability.

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