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**Local effects of apical oxygen on superconductivity in high-$T_c$ cuprates** MICHIYASU MORI, Tohoku Univ., TAKAMI TOHYAMA, Kyoto Univ., SADAMICHI MAEKAWA, Tohoku Univ. — The superconducting critical temperature ($T_c$) of high- $T_c$ cuprates widely distributes among various series of crystal structures, even if the doping rate is optimized in the $CuO_2$ planes. In addition, the $T_c$ is enhanced by applying pressure[1]. These material- and pressure dependences have meaningful correlation with an energy difference of oxygen sites in an apical site and in the $CuO_2$ plane ($V_A$)[2]. On the other hand, Slezak et al. has found that locally modulated gap energy has anti-correlation with a distance between a Cu- and an apical O-sites, i.e., the larger distance is related to the smaller gap energy[3]. We study such a local effect of apical oxygen on superconductivity by calculating the Madelung potential. In particular, we focus on a local variation of $V_A$, whose value approximately corresponds to stability of the Zhang- Rice singlet state[2]. It is found that, on neighboring sites of apical sites close to Cu sites, $V_A$ are locally enhanced compared to other sites. To estimate the gap energy, we propose a toy model like a BCS mean field Hamiltonian with an additional degree of freedom, which describes a role of apical oxygen. We will discuss an anti-correlation between the gap energy and the position of apical oxygen. [1] N. Tanahashi et al: Jpn. J. Appl. Phys. 28, L762 (1989). [2] Y. Ohta, T. Tohyama, and S. Maekawa: Phys. Rev. B 43, 2968 (1991). [3] J. Slezak, PhD thesis.

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