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Doped Valence Bond Solid and Superconductivity on the Shastry-Sutherland Lattice BOHM-JUNG YANG, Department of Physics and Astronomy, Seoul National University, Seoul, Korea, YONG BAEK KIM, Department of Physics, University of Toronto, Toronto, Ontario, Canada, JAEJUN YU, Department of Physics and Astronomy, Seoul National University, Seoul, Korea, KWON PARK, School of Physics, Korea Institute for Advanced Study, Seoul, Korea — Motivated by recent experiments on $SrCu_2(BO_3)_2$, we present a theoretical framework for understanding the ground states of the doped Mott insulator on the Shastry-Sutherland lattice. To provide a unified theoretical framework for both the valence bond solid state found in undoped $SrCu_2(BO_3)_2$ and the doped counterpart in ongoing experimental pursuit, we analyzed the t-J-V model via the bond operator formalism. The interplay between strong dimerization and the nearest-neighbor repulsive interaction leads to different behaviors of the doped holes determining the overall phase diagram. Specifically, if the nearest-neighbor repulsive interaction, V, is smaller than a critical value, V_c, the hole-pairing within dimers is preferred, resulting in the S- wave superconductivity at any non-zero x. On the other hand, if V is larger than V_c, the density of paired-holes within the same dimers vanishes at finite x and the plaquette D-wave superconductivity with a peculiar spatial pattern emerges. Implications to future experiments are discussed.

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