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Emergence of superconductivity, valence bond order and Mott insulators in Pd[(dmit)2] based organic salts[1]

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The $EtMe_3P$ and $EtMe_3Sb$ nearly triangular organic salts are distinguished from most other $Pd[(dmit)_2]$ based salts, as they display valence bond and no long range order, respectively. Under pressure, a superconducting phase is revealed in $EtMe_3P$ near the boundary of valence bond order. We use slave-rotor theory with an enlarged unit cell to study competition between uniform and broken translational symmetry states, offering a theoretical framework capturing the superconducting, valence bond order, spin liquid, and metallic phases on an isotropic triangular lattice. Our finite temperature phase diagram manifests a remarkable resemblance to the phase diagram of the $EtMe_3P$ salt, where the re-entrant transitions of the type insulator-metal-insulator can be explained by an entropy difference between metal and the U(1) spin liquid. We find that the superconducting pairing symmetry is $d \pm id$, and predict different temperature dependences of the specific heat between the spin liquid and metal.

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