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A round-trip from spin to quantum dimer models MATTHIEU MAMBRINI, FABIEN ALET, CNRS, Université de Toulouse, F-31062 France, SYLVAIN CAPPONI, Université de Toulouse, F-31062 France — Short-range valence bonds wave-functions are often used as a paradigm for non-magnetic states (such as spin liquids or valence bond crystals). Recently, two local S=1/2 spin Hamiltonians which admits nearest neighbor valence bond wave-function(s) as ground-state(s) on the square lattice have been proposed by Cano and Fendley [Phys. Rev. Lett. **105**, 067205 (2010)]. We present a numerical study, by means of exact diagonalizations and diagonalizations restricted in the subspace spanned by nearest neighbor valence bond states, of the ground state and excitations of these models. We show that it corresponds to a new type of spin liquid state, with gapped spin but gapless non-magnetic excitations. Mixing the two models is shown to stabilize valence bond crystal ground states that are very reminiscent of the phases present in the Rokhsar-Kivelson quantum dimer model phase diagram. Using a generic mapping scheme [Phys. Rev. B **81**, 214413 (2010)] of spin hamiltonians to generalized quantum dimer models we show how this correspondence between the phase diagram of a local S=1/2 spin hamiltonian and the Rokhsar-Kivelson quantum dimer model can be understood.

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