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Nature of the spin liquid state of the Hubbard model on the honeycomb lattice BRYAN CLARK, DMITRY ABANIN, PCTS, Department of Physics, Princeton University, SHIVAJI SONDHI, Department of Physics, Princeton University — Recent numerical work (Nature 464, 847 (2010)) indicates the existence of a spin liquid phase (SL) that intervenes between the antiferromagnetic and semimetallic phases of the half filled Hubbard model on a honeycomb lattice. To better understand the nature of this exotic phase, we study the quantum $J_1 - J_2$ spin model on the honeycomb lattice, which provides an effective description of the Mott insulating region of the Hubbard model. Employing the variational Monte Carlo approach, we analyze the phase diagram of the model, finding a phase transition between antiferromagnet and an unusual Z_2 SL state which we identify as the SL phase of the Hubbard model. At higher $J_2/J_1 > 0.3$ we find a transition to a dimerized state with spontaneously broken rotational symmetry.

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