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Gapped Z_2 spin liquid and chiral antiferromagnetic phase in Hubbard model on the honeycomb lattice YUAN-MING LU, YING RAN, Boston College — In Schwinger-fermion representation we identify a Z_2 spin liquid called the sublattice-pairing state (SPS) as the gapped spin liquid phase discovered in recent Quantum Monte study of Hubbard model on a honeycomb lattice. We show that SPS is identical to the zero-flux Z_2 spin liquid state in Schwinger-boson representation by an explicit duality transformation. SPS is connected to an *unusual* antiferromagnetic ordered phase, which we term as chiral-antiferromagnetic (CAF) phase, through an $O(4)$ critical point. CAF phase breaks $SU(2)$ spin rotation symmetry completely and has three Goldstone modes. Our results indicate that there is likely a hidden phase transition between CAF phase and the usual antiferromagnetic (Neel) phase at large U/t . We also propose numerical measurements to reveal the CAF phase and the hidden phase transition.

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