

Abstract Submitted  
for the MAR13 Meeting of  
The American Physical Society

**Gapless spin liquid phase in the J1-J2 Heisenberg model** WENJUN HU, FEDERICO BECCA, SANDRO SORELLA, Democritos Simulation Center CNR-IOM Istituto Officina dei Materiali and International School for Advanced Studies (SISSA) — We study the stability of a  $Z_2$  spin liquid in the highly frustrated regime of the J1-J2 Heisenberg model in the square lattice, namely with nearest and next nearest antiferromagnetic superexchange interactions. We use state of the art quantum Monte Carlo methods[S. Sorella *et al.*, prl **88**, 117002 (2002)] and show that, by means of few Lanczos steps acting over our initial wave function, we can achieve basically exact energies for the ground state and the low lying spin excitations, whenever our results can be compared with exact diagonalization reference data. For large clusters we show evidence that our calculations remain very accurate because we can estimate exact eigenvalues by extrapolating our results to the exact zero variance limit. By taking into account these important corrections, our final phase diagram seems to be inconsistent with an opening of a sizable spin gap in the spin liquid region, as recently found by a DMRG study [H.-C. Jiang *et al.*, prl **86**, 024424 (2012)].

Wenjun Hu  
Democritos Simulation Center CNR-IOM Istituto Officina dei  
Materiali and International School for Advanced Studies (SISSA)

Date submitted: 15 Nov 2012

Electronic form version 1.4