Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

**Projective symmetry group classification of $Z_3$ parafermion spin liquids on a honeycomb lattice**[1] ZHAO-YANG DONG, SHUN-LI YU, JIAN-XIN LI, Nanjing University — To study the exotic excitations described by parafermions in the possible liquid states of SU(n)-spin system, we introduce a parafermion parton approach. We find that the SU(n)-spin can be decomposed into the $n$ parafermion matrices. As an application, we study the 1-dimensional(D) three-state clock model and generalized Kitaev model by a mean-field theory. Generalized Kitaev model hosts the symmetry of a combination of parity and time-reversal(PT) rather than either of them respectively. Moreover, there is also loop symmetries, which can be taken as Wilson loops in the parafermion representation. The mean-field Hamiltonian is expected to have a $Z_3$ gauge symmetry. If all the symmetries are projectively realized, its projective symmetry group(PSG) is suggested to be $(\Phi_p)$(I) due to our classification of $Z_3$ PSGs on a honeycomb lattice. We conclude that with the symmetries of translations, 6-fold rotation and PT, there are nine types and 102 solutions for 2-D $Z_3$ parafermion spin liquids on the honeycomb lattice. While, there will be nine types and 36 solutions if both parity and time-reversal symmetries are present. Our results provide a novel route for the systematic search for new types of spin liquids with parafermion excitations.

[1]This work was supported by the National Natural Science Foundationof China (11190023, 11374138 and 11674158) and National Key Projectsfor Research and Development of China (Grant No. 2016YFA0300401).

Zhao-Yang Dong
Nanjing University

Date submitted: 03 Jan 2017 Electronic form version 1.4