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**Simplex valence-bond crystal in the spin-1 kagome Heisenberg antiferromagnet**[1] WEI LI, Ludwig-Maximilians-Universität, TAO LIU, University of Chinese Academy of Sciences, ANDREAS WEICHSELBAUM, JAN VON DELFT, Ludwig-Maximilians-Universität, GANG SU, University of Chinese Academy of Sciences — We investigate the ground state properties of a spin-1 kagome antiferromagnetic Heisenberg model using tensor-network (TN) methods. We find a ground state with trimerization (simplex) valence-bond order, and obtain the energy per site $e_0 = -1.4099$ ($D = 16$) by accurate calculations directly in the thermodynamic limit. The symmetry between the two kinds of triangles is spontaneously broken, with a relative energy difference of $\delta \approx 20\%$. The spin-spin, dimer-dimer, and chirality-chirality correlation functions are found to decay exponentially with a rather short correlation length, showing that the ground state is gapped. We thus identify the ground state be a simplex valence-bond crystal (SVBC). We also discuss the spin-1 bilinear-biquadratic Heisenberg model on a kagome lattice, and determine its ground state phase diagram, find a quantum phase transition between the SVBC and a ferro-quadrupolar nematic state. Moreover, we implement non-abelian symmetries, here spin SU(2), in the TN algorithm, which improves the efficiency greatly and provides insight into the tensor structures.

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