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Valence bond solid (AKLT) state from t_{2g} electrons MACIEJ KOCH-JANUSZ, Weizmann Institute of Science, Israel, DANIEL KHOMSKII, University of Cologne, ERAN SELA, Tel Aviv University — The models constructed by Affleck, Kennedy, Lieb, and Tasaki (AKLT) describe gapped quantum spin liquids with fractionalized boundary spin excitations. The AKLT spin-spin interactions consist of projection operators onto the maximal possible spin formed between nearest neighbours, which involves a linear combination of powers of the Heisenberg coupling $(\vec{S}_i \cdot \vec{S}_j)^n$, making these states difficult to realize. Indeed, except for the one dimensional spin-1 case, simple antiferromagnetic Heisenberg interactions which are typically found in magnetic insulators, do not stabilize these spin liquid states, but rather generate conventional antiferromagnetically ordered states. We show that this type of interactions can be generated by orbital physics in multiorbital Mott insulators. Motivated by microscopic modeling of spin-orbit entangled Mott insulators such as the layered hexagonal Iridates, we focus on t_{2g} electrons on the honeycomb lattice and propose a physical realization of the spin-3/2 AKLT state. Interestingly enough, the valence bond solid (AKLT) state found for the noninteracting electrons survives the increase of the on-site (Hubbard) repulsion, but it changes to the antiferromagnetic Neel state with increase of the Hund's rule coupling.

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