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Order and Disorder in AKLT Antiferromagnets in Three Dimensions[1] SIDDHARTH PARAMESWARAN, S.L. SONDHI, Princeton University, DANIEL AROVAS, UC San Diego — The models constructed by Affleck, Kennedy, Lieb, and Tasaki (PRL **59**, 799 (1987)) describe a family of quantum antiferromagnets on arbitrary lattices, where the local spin S is an integer multiple M of half the lattice coordination number. The equal time quantum correlations in their ground states may be computed as finite temperature correlations of a classical $\mathsf{O}(3)$ model on the same lattice, where the temperature is given by $T = 1/M$. In dimensions $d = 1$ and $d = 2$ this mapping implies that all AKLT states are quantum disordered. We consider the $d = 3$ case where the nature of the AKLT states is now a question of detail depending upon the choice of lattice and spin; for sufficiently large S some form of Néel order is almost inevitable. On the unfrustrated cubic lattice, we find that all AKLT states are ordered while for the unfrustrated diamond lattice the minimal $S = 2$ state is disordered while all other states are ordered. On the frustrated pyrochlore lattice, we find (conservatively) that several states starting with the minimal $S = 3$ state are disordered. These are a significant addition to the catalog of magnetic Hamiltonians in $d = 3$ with ground states known to lack order on account of strong quantum fluctuations.

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