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Berry phases emerging from the π-flux state AKIHIRO TANAKA, National Institute for Materials Science, XIAO HU, National Institute for Materials Science — We derive a new effective action describing fluctuations around the Affleck-Marston π-flux mean-field solution of the 2d Heisenberg antiferromagnet. The 5-dimensional Clifford algebra inherent in the Dirac fermion obtained as the continuum limit of the π-flux state is found to sustain a bulit-in competition between antiferromagnet (AF) and valence-bond-solid (VBS) orders. This naturally leads us to cast both orderings as components of a 5 component vectorial field v, for which we obtain an O(5) nonlinear sigma model with a novel Wess- Zumino (WZ) term proportional to the Mauer-Cartan form $\int_0^1 dt \int d^3x v dv \wedge dv \wedge dv \wedge dv$, with $t \in [0,1]$ an auxiliary variable which extends $v(x)$ to $v(t,x)$ in such a way that $v(t=0,x) \equiv (0,0,0,0,1)$ and $v(t=1,x) \equiv v(x)$ are satisfied. We study properties of Berry phases extracted from this WZ term, and recover in particular the AF hedgehog Berry phases (with a VBS core) which are central to recent studies on 2D spin liquids.

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