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A Geometric Representation of Correlations: Unveiling Hidden Correlation Structures in Ultracold Matter KENNETH WANG, ANTHONY MIRASOLA, IAN WHITE, RICK MUKHERJEE, KADEN HAZZARD, Rice Univ — We develop a general method to visualize spin correlations and demonstrate its usefulness for ultracold systems, from fermions in lattices to trapped ions and ultracold molecules. We provide a one-to-one map between the spin correlations and certain three-dimensional objects, analogous to the map between single spins and Bloch vectors. Moreover, much as one can reason geometrically about dynamics using a Bloch vector – e.g. a magnetic field causes it to precess and dephasing causes it to shrink – we show that analogous reasoning holds for our visualization of correlations for real physical spin models. Phenomena that look complicated and mysterious when analyzed by the components of their correlations become simple and intuitive when described geometrically. Finally, we will describe how this geometric representation not only reveals a surprising similarity of behaviors in a wide range of spin models, but also provides insight into the accuracy of various approximations to the dynamics.

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