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Understanding Geometrically Frustrated Magnets Without Getting Frustrated

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In geometrically frustrated magnets, the positions of the magnetic moments within the crystal lattice prevent the simultaneous satisfaction of competing magnetic interactions. As a result, magnetic ordering is suppressed and a variety of exotic phenomena may ensue, such as macroscopic ground-state degeneracy, extreme sensitivity to perturbations, and the formation of a quantum spin liquid. Experimental studies of the magnetic correlations in frustrated magnets have historically been very challenging due to the suppression of long-range magnetic order, limiting our ability to understand the consequences of geometrical frustration using conventional techniques. Here, I will introduce atomic and magnetic pair distribution function (PDF) analysis, a method of analyzing neutron scattering data to study short-range atomic and magnetic correlations. I will then discuss the case of the frustrated triangular antiferromagnet $NaMnO_2$ as an example of how PDF methods provide unique insight into the unusual behavior of frustrated magnets. This example teaches us that geometrically frustrated magnets need not be so frustrating after all, as long as we use the right tools.