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Quantum order-by-disorder and excitations in anisotropic kagome-lattice antiferromagnets[1]

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Our recent works have advanced theoretical understanding of the quantum effects in kagome-lattice antiferromagnets and have provided insights into the quantum order-by-disorder mechanism, important for a broad class of frustrated spin systems. In particular, we have challenged a general expectation that the quantum and thermal order-by-disorder mechanisms always select the same ground state. We have shown that the non-linear terms in the quantum hamiltonian of the anisotropic kagome-lattice antiferromagnets can yield a rare example of the ground state that is different from the one favored by thermal fluctuations. We have also demonstrated that the order selection is generated by topologically non-trivial tunneling processes, yielding a new energy scale in the system.

Related to the ground-state selection mechanism are the non-linear effects in the spectra of the kagome-lattice systems. Further progress has been made in understanding spectral properties of realistic kagome-lattice antiferromagnets such as Fe-jarosite, for which we have demonstrated a remarkable wipe-out effect for a significant portion of the spectrum. This phenomenon is related to an existence of the so-called "flat mode," a ubiquitous feature of the kagome-lattice and other highly-frustrated antiferromagnets, and is due to a resonant-like decay processes involving two of such modes.

References: [1] A. L. Chernyshev and M. E. Zhitomirsky, "Quantum Selection of Order in an XXZ Antiferromagnet on a Kagom'e Lattice", Phys. Rev. Lett. 113, 237202 (2014). [2] A. L. Chernyshev, "Strong quantum effects in an almost classical antiferromagnet on a kagome lattice", Phys. Rev. B 92, 094409 (2015). [3] A. L. Chernyshev and M. E. Zhitomirsky, "Order and excitations in large-S kagome-lattice antiferromagnets", Phys. Rev. B 92, 144415 (2015). (Editors' Suggestion).

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