The antiferromagnetic XY-model on the layered triangular lattice: Chirality transitions in a rigid regime

The antiferromagnetic XY-model on the (layered) triangular lattice is a canonical example of a geometrically frustrated spin system. In general, the XY-model energy is defined on discrete order parameters u mapping from the lattice to the unit circle $\mathbb{S}^1$ and in the antiferromagnetic model this energy favors u to take opposite values in neighboring lattice points. However, the structure of the (layered) triangular lattice does not allow u to do this for all nearest neighbors simultanously. In other words, the energy cannot be minimized by minimizing all pairwise interactions. This is what is referred to as geometric frustration. As a result of frustration, the energy landscape of these systems becomes very rich, meaning that energy can concentrate on many different scales. In this context, Γ-convergence is a useful tool to pass to a (simpler) continuum model while still keeping the scale-dependent relevant information. In this talk, we will carry out such a discrete-to-continuum Γ-convergence analysis in a scaling regime where in the continuum limit the so-called chirality variable develops sharp interfaces.

This is joint work with Rafael Galleze (TU Eindhoven).