Ground states of a system of classical spins on an anisotropic triangular lattice and the spin-liquid problem in $NiGa_2S_4$ and $FeGa_2S_4$ compounds

Yu. Dublenych

Institute for Condensed Matter Physics of the National Academy of Sciences of Ukraine, 1 Svientsitskii Str., 79011 Lviv, Ukraine, E–mail: dubl@icmp.lviv.ua

It is shown that the ground states of a system of classical spins on an anisotropic triangular lattice with interactions within an elementary triangular plaquette can be constructed by minimizing the energy of a single plaquette. Even in the case when all three angles between plaquette spins are different, there exist five global ground-state configurations with equal energies. The most complex of these is an incommensurate four-sublattice conical spiral structure. Our results may shed some new light on the experimentally observed spin-liquid-like disorder in $NiGa_2S_4$ and $FeGa_2S_4$ where a four-sublattice spin structure were observed.

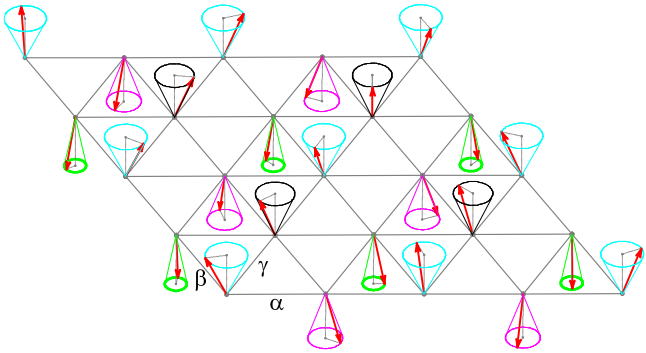

Figure 1: An example of four-sublattice spin configuration on an anisotropic triangular lattice. The angles between neighboring spins are equal to α, β, and γ. The cones for different sublattices are depicted in different colors. Within each sublattice, the spin structure is a simple spiral conical structure but on a triangular lattice with doubled lattice periods. The axes of all the cones are parallel.