Quantum Magnetism of Effective Models

Frédéric Mila[1]

[1]Institute of Physics, Ecole Polytechnique Fédérale de Lausanne, 1015 Lausanne, Switzerland

Abstract. In this lecture, I will review the properties of the quantum Heisenberg model and of some of its extensions, including an external magnetic field, with emphasis on the physical properties of the various types of phases that have been proposed and sometimes observed: magnetic long-range order, spin nematic order, algebraic order, gapped systems, Resonating Valence Bond liquids, and chiral spin liquids. In all cases, I will discuss simple models where the relevant physics has been demonstrated, and whenever possible I will mention experimental realizations. On the way, I will also discuss the main theoretical and numerical tools that have proven most useful to describe this very rich family of quantum states of matter.

Suggested introductory readings (textbook, review or articles)

1. Introduction to Frustrated Magnetism, C. Lacroix, P. Mendels, F. Mila (Eds.), Springer (2011).
2. Frustrated Spin Systems, F. Mila, Lecture Notes of the Autum School on Correlated Electrons 2015, Eva Pavarini, Erik Koch, and Piers Coleman (Eds.), Forschungszentrum Jülich GmbH, Chapter 7.