

Integrated Graduate School

Date: Friday, Nov. 16, 2012

Time: 10:00 – 11:30

Place: Glaspalast, FRM II Garching (seminar room to the left hand side of the front entrance of FRM II)
Technische Universität München



Focused Lecture of the Collaborative Research Centre/Transregio TRR 80:

Berry's phase and the semiclassical quantization of spin systems

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Traditionally, spin systems are described either classically or quantum mechanically. For example, strongly correlated electron systems such as spin-1/2 quantum spin chains are treated quantum mechanically, while magnetization dynamics of domain structures in nanoscale systems are treated classically, for example via the Landau-Lifshitz equation. Correspondingly, only little is known about the intermediate regime and how one may use classical dynamics as a starting point for a semiclassical quantization. For such a semiclassical quantization, Berry's phase plays a crucial role and ensures the correct implementation of time reversal invariance for half-integer spin systems. In this focussed lecture, an introduction into the concept of the spin Berry-phase is given and it will be demonstrated how simple spin systems are quantized semiclassically. For example, it is shown how the dynamics of an anisotropic spin is analogous to that of a charged particle orbiting a flux line experiencing an Aharonov-Bohm effect. Semiclassical quantization via Berry's phase also demonstrates how the chirality of classical magnetic textures leads to the existence of quantum spin currents which can be measured.

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