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Infinite dimensional semiclassical analysis and applications to a model in NMR.

We are interested in the approximation of the quantum evolution of observables for N fixed particles with spin $1/2$, interacting with the quantized electromagnetic field, and a constant magnetic field. This is the Nuclear Magnetic Resonance, modelized in the framework of Quantum Electrodynamics, closely to the spin-boson model.

The observables may be the electric or magnetic field at each point, or a spin observable. If A is such an operator, and if H is the Hamiltonian, we study the Wick symbol of $e^{i(t/h)H}Ae^{-i(t/h)H}$. Formally, it has a semiclassical expansion, each term satisfying a differential equation given by the Mizrahi series (which gives the Wick symbol of a composed operator).

The first term satisfies the Bloch equations (1946), coupled with the Maxwell system. All the others give quantum corrections to these equations.

In order to control the error, the main point is that, for each function F on the (infinite dimensional) phase space satisfying suitable estimations for its differentials of all orders, we can find an operator whose Wick symbol is F, and we can control its norm. Similar techniques are used in the pseudodifferential calculus in $\mathbb{R}^n$ and, in the Fock space, for polynomials (Wick order). All our terms satisfy these conditions, and the Wick quantization enables us to estimate the error for the Wick symbol.

(With L. Amour and L. Jager, arXiv:1705.07097, new version march 2018.)