

Basic Comments on the Maxwell-Bloch System

Florian Platzek

26.02.2013

Abstract

The interaction of matter and light can be described by the Maxwell-Bloch system. The system couples the classical Maxwell equations for the electro magnetic field (E, H) for light with a quantum mechanical equation for the matter, which is described by the density matrix ρ . The main focus of this talk lies on the presentation of existence and uniqueness results for the semilinear symmetric hyperbolic system

$$\begin{aligned}\partial_t E - \operatorname{curl} H &= -\partial_t P \\ \partial_t H + \operatorname{curl} E &= 0 \\ i\partial_t \rho &= [\Omega - \Gamma E, \rho],\end{aligned}$$

where the coupling is given via $P = \operatorname{Tr}(\Gamma\rho)$. Following closely the lines of [JMR2000], one is lead to a special case of the results from [Dumas2005], where both a more general right hand side and a more general coupling are considered. Besides this, some general comments on the structure of the system, the conserved quantities and the physical background are made.

[JMR2000] J.L. Joly & G. Métivier & J. Rauch, *Global Solutions to Maxwell Equations in a Ferromagnetic Medium*, Ann. Henri Poincaré (2000) p. 307-340, Birkhäuser Verlag, Basel.

[Dumas2005] É. Dumas, *Global Existence for Maxwell-Bloch Systems*, J. Diff. Eq 219 (2005) p. 484-509.