Basic Comments on the Maxwell-Bloch System

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Abstract

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

\[
\begin{align*}
\partial_t E - \text{curl} H &= -\partial_t P \\
\partial_t H + \text{curl} E &= 0 \\
i\partial_t \rho &= [\Omega - \Gamma E, \rho],
\end{align*}
\]

where the coupling is given via \(P = \text{Tr}(\Gamma \rho)\). 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.
