

Causal signal transmission by interacting quantum fields

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A response formulation of interacting quantum fields is discussed. This formulation may be regarded a marriage of Kubo's linear response theory and Glauber's photodetection theory, being formally a generalisation of the former to the nonlinear stochastic response properties of quantum systems. We derive a response transformation mapping the conventional Green-function formulation of the quantum field theory on a formulation in terms of quantum-statistical response functions. We also derive formulae linking response functions to Green's functions and vice versa, of which Kubo's famous formula for the linear response function is the simplest example. In view of the universal nature of the response transformation it can be identified in the generic case of a driven harmonic oscillator. The general case of interacting fields, both bosonic and fermionic, is then a matter of straightforward generalisation.