Quantum Physics

Proca equations derived from first principles

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(Submitted on 21 Jan 2009)

Gersten has shown how Maxwell equations can be derived from first principles, similar to those which have been used to obtain the Dirac relativistic electron equation. We show how Proca equations can be also deduced from first principles, similar to those which have been used to find Dirac and Maxwell equations. Contrary to Maxwell equations, it is necessary to introduce a potential in order to transform a second order differential equation, as the Klein-Gordon equation, into a first order differential equation, like Proca equations.

Comments: 6 pages
Subjects: **Quantum Physics (quant-ph)**
Cite as: **arXiv:0901.3300v1 [quant-ph]**

Submission history

From: Gondran Michel [view email]
[v1] Wed, 21 Jan 2009 16:12:37 GMT (4kb)

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