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Hamiltonians & degrees of freedom in ”Lorentz-violating” field theories

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Many classical field models which “violate Lorentz symmetry” do so via a vector or tensor field which takes on a vacuum expectation value, thereby spontaneously breaking the underlying Lorentz symmetry of the Lagrangian. To obtain a tensor field with this behavior, one can posit a smooth potential for this field, or one can enforce a non-zero tensor value via a Lagrange multiplier. In this talk, I will discuss the unexpected effects that can arise when one tries to construct a field model in this way. In particular, the number of degrees of freedom of the model is not necessarily reduced, compared to a theory with a smooth potential, when one “constrains” the field via a Lagrange multiplier; and for certain field theories with a potential, the equations of motion do not allow the field to evolve smoothly on and off of the vacuum manifold.

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