Title: How can there be a CPT theorem?

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The CPT theorem of quantum field theory states that any relativistic (Lorentz-invariant) quantum field theory must also be invariant under CPT, the composition of charge conjugation, parity reversal and time reversal.

Prima facie, this is a puzzling result. In the first instance, it is opaque how it can come about that come about that one symmetry (e.g. Lorentz invariance) entails another (e.g. CPT) *at all*. Secondly, it is particularly puzzling how charge conjugation, not obviously a spatiotemporal symmetry at all, can be so intimately linked to spatiotemporal notions such as parity reversal, time reversal, Lorentz invariance. Thirdly, all this is supposed to be a peculiarly quantum-theoretic phenomenon, with no classical analog – but it is opaque which feature peculiar to the quantum theory might be responsible for facilitating the result.

As with most cases of puzzlement, this can be taken as an opportunity rather than as an obstacle to understanding – there must exist a point of view from which the CPT theorem is not puzzling at all, but is, rather, precisely to be expected. The attainment of this point of view is the purpose of the present paper.

The paper develops three inter-related claims. The first is that, contra the standard view, there is nothing peculiarly quantum-theoretic about the CPT theorem --- it has a straightforward analog in *classical* field theory. (This point was made by J S Bell in 1955, but does not seem to be well known.) The second is that the operator usually called ‘TC’ is (in a certain mathematical sense) more properly understood as time reversal alone; hence the CPT theorem is more properly understood as a ‘PT’ theorem, and our puzzle about how charge conjugation can come to be so intimately connected to spatiotemporal symmetries dissolves. The third is that, once the CPT theorem has thus been reinterpreted as a PT theorem, it is not at all difficult to understand how Lorentz invariance can force the result: surprisingly, though, the explanation comes from the fact that (in a sense I explain) it is not possible for a Lorentz-invariant theory to make essential use of a temporal orientation. (A corollary of this explanation is that the so-called ‘T violation’ of particle physics does *not* show that physics makes use of a fundamental distinction between the past and future directions of time: no Lorentz-invariant theory can, and the geometrical explanation of T violation is to be found elsewhere.)