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Causal localizations in relativistic quantum mechanics.

So far, there has been no attempt to make a concrete connection between causal localizations and Dirac's theory, i.e. to show that Dirac's theory is causal in the sense that there exists a causal localization whose energy operator is the Dirac operator. Sufficient and necessary conditions for finite causal localizations are presented and we will see that the Dirac system is indeed causal. Moreover, we succeed in showing that there are further previously unknown causal localizations. We give a complete description of the irreducible causal localizations for massive systems. It turns out that they are closely related to the Dirac system – we will call them Dirac tensor systems. A formula for their relativistic extension is given. For these systems the existence of arbitrarily good localized states of positive energy are shown.