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Relativistic quantum reference frames

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Progress in physics, from Aristotelian physics, to Galilean and Newtonian physics, and then to both special and general relativity, can be viewed as a continual refinement of the notion of a reference frame. The next natural step in this progression is the idea of a quantum reference frame. In this talk, I will introduce the basic tools that have been developed to study quantum reference frames and examine how they may be applied to relativistic scenarios. In particular, I will look at how two observers in different Lorentz frames that are partially correlated can communicate via the exchange of a single massive spin-1/2 particle. I will then construct an alternative approach to quantum reference frames involving a trace over global degrees of freedom, rather than an average over all possible orientations of a system with respect to an external reference frame. This approach is anticipated to help deal with reference frames associated with non-compact groups, such as the Galilean group and Poincare group.

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