

Gauge invariance for generally covariant systems

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Previous analyses on the gauge invariance of the action for a generally covariant system are generalized. It is shown that if the action principle is properly improved, there is as much gauge freedom at the end points for an arbitrary gauge system as there is for a system with "internal" gauge symmetries. The key point is to correctly identify the boundary conditions for the allowed histories and to include the appropriate end-point contribution in the action. The path integral is then discussed. It is proved that by employing the improved action, one can use time-independent canonical gauges even in the case of generally covariant theories. From the point of view of the action and the path integral, there is thus no conceptual difference between general covariance and "ordinary gauge invariance". The discussion is illustrated in the case of the point particle, for which various canonical gauges are considered. © 1992.