Mathematical Physics

Homotopical Poisson reduction of gauge theories

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The classical Poisson reduction of a given Lagrangian system with (local) gauge symmetries has to be done before its quantization. We propose here a coordinate free and self-contained mathematical presentation of the covariant Batalin-Vilkovisky Poisson reduction of a general gauge theory. It was explained in physical terms (DeWitt indices) in Henneaux and Teitelboim's book on quantization of gauge theories. It was studied in coordinates using jet spaces by Barnich-Brandt-Henneaux and Stasheff, among others. The main idea of our approach is to use the functor of point approach to spaces of fields to gain coordinate free geometrical insights on the spaces in play, and to focus on the notion of Noether identities, that is a simple replacement of the notion of gauge symmetry, harder to handle algebraically. Our main results are a precise formulation and understanding of the optimal finiteness hypothesis necessary for the existence of a solution of the classical master equation, and an interpretation of the Batalin-Vilkovisky construction in the setting of homotopical geometry of non-linear partial differential equations.

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