

On supersymmetric states in \mathbf{C}^* -systems

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2009. Nov. 3

In 1997, Buchholz and Ojima provided a \mathbf{C}^* -algebraic framework for rigorous discussion on supersymmetry in infinitely extended systems. This is not only mathematically interesting but also useful for investigation on broken and unbroken supersymmetry for non-compact space. In this frame, they derived the following general statement: Implementation of supersymmetric transformations in Gelfand-Naimark-Segal construction inevitably implies unbroken supersymmetry for asymptotic abelian \mathbf{C}^* -dynamics.

Reviewing this remarkable model-independent result, we show some structural results on the set of supersymmetric states and on supercharge operators under seemingly realistic assumptions for continuous quantum systems, especially for quantum field models. We also prove that the zero-point energy for unbroken supersymmetry is canonically determined by the \mathbf{C}^* -dynamics without *renormalization*, which means energy subtraction by hand.

If time permits, we shall address the following question posed by Buchholz: Under which conditions do there exist invariant states under superderivations in a general \mathbf{C}^* -system?