論文の内容の要旨

論文題目：The anomaly puzzle in supersymmetric field theories
（超対称場の理論におけるアノマリー問題）

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In supersymmetric field theories, a possible inconsistency was pointed out long time ago. A sketch of the problem is as follows. In supersymmetric field theories, fields are related to other fields by supersymmetry. There always exist the fields called the energy-momentum tensor $T^{\mu\nu}$ (which is bosonic), supersymmetry current S^μ (which is fermionic), and R-symmetry current j_R^μ (which is bosonic), and they are known to be related to each other by supersymmetry as $j_R^\mu \leftrightarrow S^\mu \leftrightarrow T^{\mu\nu}$. Furthermore, the value of $\partial_\mu j_R^\mu$ and $T^\mu_{\ \mu}$ are already known from general discussions in quantum field theory without assuming the existence of supersymmetry. $\partial_\mu j_R^\mu$ is called the axial anomaly and $T^\mu_{\ \mu}$ is called the trace anomaly. However, the values of $\partial_\mu j_R^\mu$ and $T^\mu_{\ \mu}$ obtained in the general discussions apparently violate the supersymmetry $j_R^\mu \leftrightarrow S^\mu \leftrightarrow T^{\mu\nu}$. This contradiction is called the anomaly puzzle.

Many works has been done to solve the anomaly puzzle. Although some important observations have been made in this process, the solutions proposed in the literature have not convinced everyone that the anomaly puzzle is solved clearly. The aim of this thesis is to give a solution to the anomaly puzzle. Recently, a progress is made in the study of the supersymmetry structure $j_R^\mu \leftrightarrow S^\mu \leftrightarrow T^{\mu\nu}$. It has been pointed out that the structure $j_R^\mu \leftrightarrow S^\mu \leftrightarrow T^{\mu\nu}$ is not so tight than it was considered before. We propose a solution to the anomaly puzzle based on this progress and serious considerations of several subtle points in quantum field theory.