Spooky Actions at a Distance – On the Problem of Quantum Correlations

Barandun, Silvio (School: Liceo Cantonale di Locarno)

The purpose of this research work in the field of quantum theory is to clarify the nature of the two particle quantum correlation phenomenon. The work is divided in two parts. The first part is dedicated to the construction of the quantum theory itself and introduces the studied phenomenon. The designated target is to build a structurally and logically solid basis in order to give veracity to the conclusion in the second part. The second part discusses the different hypothesis formulated that tried to explain the cause of the two particle quantum correlation and describes various experiments that permitted to check the correctness or fallacy of these hypothesis. We reach an important conclusion: eighty years after the first attempt to explain this correlation, it is now possible to assert the correctness of the theory proposed by Bell, namely that the quantum theory can not be completed with any local hidden variable theory. However, a local explanation of the two particle quantum correlation can not be excluded, but so far a model with a local explanation of the two particle quantum correlation is not yet present in literature. Today, the only existing explanation of this phenomenon that is not confuted by experimental evidences is therefore a non-local action between the particles. Another explanation is yet possible: as argued by a part of the scientific community, the quantum theory itself could be the local theory that explains the observed correlations. The discussion on the nature of the quantum correlation is still open and waiting for a final, convincing explanation.

Awards Won: