

Quantum Gravity: History, Historiography, and Philosophy

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The problem of how to construct and make sense of a theory that unites the principles of general relativity (Einstein's classical field-theoretic theory of space, time, and gravitation) with those of quantum field theory (our framework for constructing theories for the three remaining forces: strong, weak, and electromagnetic) is widely and rightly believed to be the greatest unsolved puzzle of theoretical physics. The puzzle exposes a deep schism in the foundations of physics and, if we believe that fundamental physics tells us what kind of universe we inhabit, a deep conceptual schism in our world-view. However, despite nearly eighty years of hard labour by the best physicists of the 20th Century (including multiple Nobel Laureates, such as Dirac, Feynman, t'Hooft, and Weinberg), there is still no theory that solves the puzzle, nor is there even a consensus on how best to proceed in the struggle. Thus, the revolutionary episodes initiated by general relativity and quantum theory are left incomplete, leaving us with a fragmented conceptual scheme that we do not know how to piece together into a coherent whole. Some believe that the two sets of principles can be made to peacefully coexist; others disagree and view the modification of one or the other set of principles as an ineluctable casualty of the eventual merger.

This is the problem of quantum gravity, and it is this problem we will examine in the proposed research. Rather than trying to solve it directly—a foolhardy task given the failure rate thus far—we wish to make sense of the puzzle with the ultimate aim of indirectly aiding its resolution by providing researchers with a global historical perspective of the field (primarily in the form of an accessible monograph). In seeing how the current crop of approaches to the problem of quantum gravity got to where they are, from the same origins, and via mediating approaches, researchers will look more favourably on the other approaches they currently see themselves as competing with. The overarching aim is, then, to promote greater collaboration and understanding between the various camps and to suggest potential collaborative research avenues.