Definition and analysis of absolute structures with regards to the problem of background independence of physical theories

In times of fundamental revolutions in physics, physicists often refer to philosophy and philosophers for guidance. One of the best examples of this relationship is the creation of the general theory of relativity. Apart from a highly technical aspect of equations derivation, the creation of perhaps the most revolutionary physical theory also featured the deeply philosophical reconceptualization of space and time. Einstein's greatest achievement was shifting our understanding of space and time from Newtonian unchanging entities to geometry of spacetime. Presently, the search for the theory of quantum gravity has once again brought about a close cooperation of these two seemingly distant disciplines.

Many researchers today are of an opinion that the theory of quantum gravity should satisfy a condition of background independence. What this means is that the theory should have no absolute structures which are to constitute said background. It is however unclear what these absolute structures are. James Anderson (1964, 1967) proposed one definition, according to which an absolute object is one which acts, but which is not acted upon. To put it simply, an absolute object exerts influence on other objects of our theory, but it itself remains unchanged. While the definition seems simple enough, it does not allow for a simple binary division of the elements of our physical theories into dynamic and absolutes. There are several counterexamples to this definition, featuring objects which intuitively should be dynamic, yet according to Anderson's approach are absolute. Other definitions found in the subject literature (Anderson-Friedman, Hiskes) are either too broad (like Anderson's) or too restrictive causing intuitively absolute objects to be classed as dynamic (e.g. Lorentz metric for special relativity).

The proposed research project is designed to analyse this problematic situation and return a univocal and precise definition of an absolute object. The proposed definition will be designed to take into account the full taxonomy of the elements of out physical theories, including oft overlooked categories like constants and "confined objects". The resulting taxonomy and definitions proper are expected to shed new light not only on the already existing theories, but also, and more importantly, on the theory of quantum gravity which is currently being developed.