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Towards an ontology of quantum gravity

Modern physics rests on two firm pillars, namely, general relativity and quantum theory. Both theories enjoy huge empirical success and have wide technological applications. It is then natural to inquire into the possibility to merge these two theoretical frameworks into a unique theory of quantum gravity, in order to acquire a deeper understanding of the physical world. At the moment, one of the most worked out programs to quantize the general relativistic gravitational field is the so-called "canonical approach". However, the theories falling in the scope of the canonical program (most notably, loop quantum gravity) have to face at least three huge conceptual issues. The first is that canonical quantum-gravitational states "betray" the spirit of relativity in that they represent purely spatial, as opposed to spatiotemporal, physical degrees of freedom. The second is that the equation that describes the dynamical evolution of these states –the Wheeler-DeWitt equation– does not involve any time-like parameter, thus seemingly cutting off temporal evolution from the physical picture. The third is that quantum-gravitational states are subjected to superpositions and entanglement, which makes it very difficult to explain how stable spatiotemporal structures can emerge from the underlying quantum regime.

In this talk, I will propose a philosophical framework based on the notion of "self-subsisting" structure, which aims at moving the quantum gravity enterprise in the direction of ontological clarity. This framework combines (i) a primitive ontology approach to quantum physics, (ii) the Humean supervenience thesis, and (iii) a non-standard treatment of dependence relations. Moreover, I will point out how the dynamics of self-subsisting structures can be naturally implemented using shape space physics, which is a theoretical framework for constructing purely relational theories in a Leibnizian/Machian spirit.