AGPhil 4: Quantum Gravity 3

Time: Monday 17:00–18:45 Location: PTB SR AvHB

Invited Talk AGPhil 4.1 Mon 17:00 PTB SR AvHB

Out of nowhere: loop quantum gravity and spacetime functionalism — •Christian Wüthrich — University of Geneva, Switzerland

Quantum gravity is of great interest to the philosopher of nature: the conceptions of space and time arising from our manifest image of the world have already been challenged by general relativity, and adding quantum effects to the mix promises to add significant complications. As it turns out, most approaches to quantum gravity suggest that our world is ultimately neither spatial nor temporal. How can one conceptualize such a non-spatiotemporal world? How can space and time not be fundamental, but instead emerge from a non-spatiotemporal structure just as the liquidity of water emerges from molecules which are themselves not liquid? Using loop quantum gravity, an approach to quantum gravity based on a canonical quantization of general relativity, I will illustrate these questions, and argue how a philosophical approach known as 'spacetime functionalism' contributes to their resolution.

AGPhil 4.2 Mon 17:45 PTB SR AvHB

Causation in Quantum Gravity: an Assessment — •Luca Gasparinetti — University of Italian Switzerland, Lugano, Switzerland

Is there causation in fundamental physics? It has been argued in several places that causation does not play any legitimate role in fundamental physical theories. Based on recent developments in cutting-edge physics, I will show that this tradition can be renovated with a novel challenge. I will call it the timeless challenge. As I will present it in more detail, the challenge roughly proceeds as follows. According to several approaches to the most fundamental theory called Quantum Gravity (QG), time is fundamentally unreal. Hence, since causal relations are typically grounded in temporal relations, one might conclude that along with temporal relations, causal relations are fundamentally unreal. Therefore, there is no fundamental causation in our most fundamental physical theory. In this talk, I will reject this challenge and motivate that at least in some cases QG itself makes the case for anchoring causation in fundamental physics. In the first part, I will present in more detail the timeless challenge. In the second, based on specific approaches to QG, I will develop two strategies to address the challenge aimed at showing that there can be fundamental causation. I will finally conclude with some brief remarks on the current research about causation and QG.

AGPhil 4.3 Mon 18:15 PTB SR AvHB

Growing Block in Causal Set Theory: Not Quite — •Marco Forgione — University of Milan

In this contribution, I shall explore the possibility of characterizing the emergence of time in causal set theory (CST) in terms of the growing block universe (GBU) metaphysics. I will show that although GBU seems to be the most intuitive time metaphysics for CST, it leaves us with a number of interpretation problems, independently of which dynamics we choose to favor for the theory -here I shall consider the Classical Sequential Growth and the Covariant model. Discrete general covariance of the CSG dynamics does not allow us to individuate a single history of the universe (defined by a causal history of different causal sets), thereby making the claim that "the past exists" at best problematic. In addition, because the evolution of the universe in CSG dynamics leads to an outward branching causal tree, it becomes impossible to determine a proper "line of becoming", thereby blurring the presentists' claim that only the present exists. Similarly, the covariant approach runs into the same, if not even more severe problems, since each configuration of the universe would amount to a set of possible causal sets, thereby making the individuation of a single configuration of the universe -and thus the physical interpretation of the theory- implausible.