

Section 7

The Metaphysics of Spacetime Emergence

Organizer: Baptiste Le Bihan

Participants: Karen Crowther (University of Genova), Nick Huggett (University of Illinois at Chicago), David Yates (University of Lisbon)

Abstract:

Many approaches to quantum gravity suggest a puzzling picture of the natural world by claiming that time, space and spacetime are not fundamentally real. The natural world we live in is made of strange structures and entities, different from the familiar spatial and temporal entities we naturally refer to in daily life, and even from the ones posited in empirically confirmed theories like general relativity. How are we going to conceive of the connection between the two realms, namely the fundamental non-spatio-temporal, and the derivative spatio-temporal?

Titles and Abstracts of the talks

1.

Karen Crowther: Conceptions of Emergence in Quantum Gravity: Inter-theory Relations and Metaphysical Implications

The literature on emergence in quantum gravity (QG) is murky as a result of different authors employing different conceptions of emergence, without engagement with one another. I identify and articulate three different senses of ‘emergence’—each understood as a category of inter-theory relations—that have been used in the context of QG. These are: the ‘philosopher’s sense’ (emergence), the ‘physicist’s sense’ (correspondence), and the ‘philosopher of physics’ sense’ (eclosion). I explore the relationships between these conceptions, and their potential implications for the metaphysics of spacetime emergence.

2.

Baptiste Le Bihan: Emergence or Mereological Composition in Quantum Gravity?

I argue that the connection between general relativity and quantum gravity requires to posit some form of metaphysical relation obtaining between the spatio-temporal and the non-spatio-temporal. I propose to identify this relation to trans-categorical composition. In this view, each spatio-temporal relation described by general relativity is real, although it is composed of entities belonging to non-spatio-temporal ontological categories. The account avoids committing to a relation of ontological emergence and to a distinction between a fundamental world and a derivative world. Interestingly, it also escapes the radical claim that spacetime is not real at all. Spacetime is emergent in the weak sense that it is composed of non-spatio-temporal entities.

3.

Nick Huggett: The Physical Emergence of Spacetime

I approach the metaphysical problem of the ‘emergence of spacetime’ as a problem for the development of physical theory. From that perspective, there is an alleged problem of

'physical salience' for a physical account of spacetime in more fundamental, but non-spatiotemporal terms— isn't a non-spatiotemporal account instrumental rather than physical? The problem faces two ways, with two solutions. Downwards, how can we understand 'physicality' for the non-spatiotemporal? Upwards, how could something non-spatiotemporal behave as something spatiotemporal? I argue that concrete derivations of spacetime provide answers—and hence physics contributes to our metaphysical understanding of the world.

4.

David Yates: Ontologically Emergent Spacetime

The claim that spacetime is emergent in quantum gravity is often expressed in such a way as to leave open its ontological status. I argue that if spacetime is emergent, then it is ontologically emergent. I first argue that spacetime is plausibly metaphysically fundamental, based on the independently motivated claim that fundamental properties such as electric charge are individuated by dispositional roles that are spatiotemporally defined. I then argue that we can make sense of ontologically emergent spacetime without positing a sui generis emergence relation, on the basis that at least some forms of grounding are consistent with fundamentality.