Project Description

Statement of Significance:

Our project concerns the foundations of theories of quantum gravity (QG): theories which propose a quantum mechanical treatment of the dynamics of spacetime found in general relativity. Over the last 20-30 years a great deal of effort has been put into various theoretical programs: e.g., string theory, canonical quantization, and related proposals. Such revolutionary theories postulate novel, fundamentally different accounts of space and time, to which existing conceptions do not apply, and which undermine our whole picture of nature. Hence QG presents foundational problems: for instance, the 'fading away' of a background spacetime (e.g., Witten 1996) or the 'problem of time' and the nature of change (e.g., Rovelli 2004). All the same, to date the emphasis has been on formal rather than conceptual developments; moreover, philosophers, who have a stake in understanding space and time, have only just started to pay systematic attention to QG (see the articles in Studies in History and Philosophy of Modern Physics, 2013 and 2014). The proposed project would support the conceptual development of QG, involving philosophers with physicists in shared enquiry.

Much of the research to be carried out by the core group members would be in the fields of philosophy and foundations of physics, but it will support other grant funded activities that have significance for philosophy and the public understanding of the implications of QG on the one hand, and for physics and the development of a theory of QG on the other. 'Project Activities' contains a more detailed account of the proposed research, but the loci are: how can classical space and time 'emerge' from a quantum structure that may be quite different? What implications does QG have for cosmology and hence our cosmological understanding of the universe? And what is the nature of existence and possibility in a picture without familiar conceptions of space and time? While these questions are of the most profound philosophical significance, as we indicated earlier, they have hardly (if at all) been touched by philosophers. We thus have the opportunity to carry out research that breaks entirely new ground in its field, introducing novel and profound issues directly connected to very contemporary science.

The philosophical significance of the project goes beyond philosophy of physics: it should be clear that the issues we raise have profound implications for many philosophical debates. But general philosophy is often criticized for a lack of responsiveness to modern physics (e.g., Ladyman and Ross 2007); the lack of serious acknowledgement of QG, as one of the most novel branches of physics is perhaps complete. (Of the 50 papers showing up in a search in philpapers.org for "quantum gravity" in the last 10 years, almost all are in physics journals; only one – Baron and Miller 2014 – is in a general philosophy journal.) The project would address this critical gap by engaging with philosophers working outside philosophy of physics as visitors to the group, and through events and media. In one direction our goal is to make the physics and related philosophical issues more generally accessible, through provocative talks, classes, videos, papers and meetings. In the other, we seek the expertise of philosophical specialists working in related topics. Historically, profound scientific changes have produced profound philosophical advances: consider Newton's effect on Kant, or Einstein's on the metaphysics of time. QG promises even more transformative philosophical insights into the deep character of the world.

Such questions would also be of great significance beyond the academy. Everyone has a stake in understanding the basic constituents of nature: whether space and time are 'appearance' or 'reality'; what the universe as a whole, from beginning to end (if they exist), is like; whether existence goes beyond space and time. All these questions bear deeply on our picture of our place and relation to the universe. In many ways, philosophy involves careful analytic scrutiny of just such questions – for just that reason. There is massive public interest in the physics of QG (e.g., Greene 1999); our project would articulate, for a general audience, the philosophical challenges that come with it.

Some physicists have recently publicly opined that philosophy is irrelevant for physics; but we agree with those, such as Carlo Rovelli and George Ellis (e.g., Horgan 2014), who believe that philosophical enquiry can be a significant component of physics. Again, the reason is that scientific reconceptualizations of nature require a new 'conceptual scheme' (e.g., Friedman 2001). The logic and empirical-theoretical role of important concepts must be identified and clarified: Einstein's analysis of space and time is a famous example, but they can be multiplied. Since classical conceptions of space and time play such an important role in theoretical concepts generally, it is certain that fundamental revisions in them will have significant ramifications. A conceptual scheme also encompasses principles and rules of application: in short, when do fundamental degrees of freedom not just agree with phenomenal ones, but actually give rise to them? In particular, when is a non-spatiotemporal derivation of spatiotemporal phenomena 'physically salient' (Maudlin 2007)? Huggett and Wüthrich (2013) argue that such questions are to be answered by systematizing empirically successful derivations. We thus conjecture that some of the problems facing the quantization of gravity are conceptual, and the project would philosophically engage with physicists in the field to work with them on these problems. (We do not suggest that philosophers alone will solve the problem; we seek collaboration, especially through visits from physicists to the group.) Thus the significance of the project also lies in its potential to contribute to the development of a theory of QG.