

AGPhil 4: Space, Time and Symmetry III

Time: Wednesday 11:00–13:00

Location: H-HS III

AGPhil 4.1 Wed 11:00 H-HS III

The history and interpretation of event horizons — ●DENNIS LEHMKUHL — Institut für Philosophie, Universität Bonn, Am Hof 1, 53113 Bonn

I will describe the conceptual evolution of what we today call the event horizons of black holes. I will first discuss Einstein's interpretation of the so-called "Schwarzschild singularity" in Schwarzschild's original coordinates of the first exact solution to the Einstein field equations, and the subsequent discussions during the 1920s of how that singularity ought to be interpreted. I will then describe Penrose's reinterpretation of the Schwarzschild solution in the late 1950s and early 1960s, inspired by Eddington-Finkelstein coordinates, and how he reconceptualised the "Schwarzschild singularity" in terms of what we today call an event horizon. In the course of comparing Einstein and Penrose, I will comment on the evolution of thoughts on real vs coordinate singularities, singularities vs event horizons, and local vs global structures of spacetime.

AGPhil 4.2 Wed 11:30 H-HS III

Information in black hole complementarity — ●SAAKSHI DULANI — University of Geneva

Lured by Wheeler's adage 'it from bit,' theoretical physicists are increasingly tempted to interpret the foundations of physics as consisting in information (bit), rather than substances such as particles or fields (it). The consequences of this informational turn are many and profound, including at the frontier of contemporary physics where the question arises whether bits of information get lost in black holes. However, there is widespread disagreement about what the relevant notion of information is. Scholars such as Maudlin [2017] and Wallace [2018] have recently argued that the Black Hole Information Paradox was never about information. 'Information loss' is just a catchy phrase to mean non-unitary evolution. I will argue that the Black Hole Information Paradox is indeed about information, a concept which urgently requires clarification. Bekenstein-Hawking entropy was cast in terms of Shannon entropy from its inception. Furthermore, to claim that black hole evaporation either violates or respects unitarity, one must invoke the behavior of von Neumann entropy, another concept which is foundationally ambiguous. As a case study, I will analyze the meaning of information in Susskind's [2008] controversial solution called Black Hole Complementarity (BHC). I will argue that BHC is incoherent because it represents a hodgepodge of contradictory philosophical positions: operationalism, realism, relationalism, and absolutism. Nonetheless, BHC offers insights into what an observer-dependent definition of information looks like.

AGPhil 4.3 Wed 12:00 H-HS III

Relativity without miracles. — ●ADÁN SUS — University of Valladolid (Spain)

It has recently been claimed that the fact that all the non-gravitational fields are locally Poincaré invariant and that these invariances coincide, in a certain regime, with the symmetries of the spacetime metric is miraculous in general relativity (GR). In this talk I will show that, in the context of GR, it is possible to account for these so-called miracles of relativity. The way to do so involves integrating the realisation that the gravitational field equations (Einstein field equations in GR) impose constraints on the behaviour of matter in a novel interpretation of the equivalence principle, which dictates the determination of local inertial frames through gravitational interaction. This proposed explanation of the miracles can also deal with the cases that are problematic (counter-examples) for the attempts at explaining the coincidence of symmetries in the context of the standard geometrical perspective on relativity theory.

AGPhil 4.4 Wed 12:30 H-HS III

Knox's spacetime functionalism and Leibniz's modal relationism — RADMILA JOVANOVIĆ KOZLOWSKI¹ and ●ANDREJ JANDRIĆ² — ¹Faculty of Philosophy, University of Belgrade, Serbia — ²Faculty of Philosophy, University of Belgrade, Serbia

In this paper we compare a new, functionalist approach to spacetime, advanced by Eleanor Knox, with Leibniz's metaphysical account, which was the most influential opposition to Newtonian substantivalism in his time. Knox's account of spacetime is inspired by Brown's dynamic approach to relativity, which is typically used as an argument for relationism, yet she uses it to defend a view which in some aspects resembles substantivalism. Knox characterises her view as "simple realism about spacetime", "substantivalism-lite" or "substantivalism stripped off the containment metaphor". According to her, spacetime is defined via its functional role in a physical theory: to determine local inertial frames. Leibniz, on the other hand, is usually classified as a relationist, although there is an ongoing debate about what type of relationism should be ascribed to him: non-modal or modal. In non-modal relationism, space and time are simply an assemblage of relations which actually obtain between objects; in modal relationism, space and time form a geometrical network of all possible positions that objects may take, even if no object actually does. We argue that the modal interpretation of Leibniz better fits textual evidence, and that it presents a proto form of functionalism in the sense of Knox.