AGPhil 3: Classical Gravity 1

Time: Monday 15:00–16:45 Location: PTB SR AvHB

AGPhil 3.1 Mon 15:00 PTB SR AvHB

On Penrose's Analogy between Curved Spacetime Regions and Optical Lenses — •Dennis Lehmkuhl, Christian Röken, and Juliusz Doboszewski — Lichtenberg Group for History and Philosophy of Physics, Institute of Philosophy, University of Bonn, Am Hof 1, 53113 Bonn

We present an analysis of the analogy between the focusing effects of particular families of Ricci- and Weyl-curved spacetime regions on the one hand and anastigmatic and astigmatic optical lenses on the other. This gravito-optical analogy was pioneered by Roger Penrose in the early 1960s. We put the analogy in its historical context, showing among other things how Penrose drew on results of Ray Sachs, and investigate its underlying assumptions, its range of validity, and how it should be interpreted.

Invited Talk AGPhil 3.2 Mon 15:30 PTB SR AvHB

Singular terms and singular spacetimes — •Tushar Menon — Dianoia Institute of Philosophy, Melbourne, Australia

The question of whether or not we should be scientific realists turns crucially on what it is to interpret a scientific theory. In this talk, I argue that the representationalist model, according to which we interpret theories by (i) deciding which objects in the world are represented (/referred to) by its central singular terms, and then (ii) making claims about these objects' properties and relations, is deeply flawed. In its place I propose a model based on a Sellars-Brandom-style inferentialism. On this view, theory interpretation is an exercise in spelling out the contribution that scientific claims make to good inferences. This model allows for a much more compelling and nuanced view about how good scientific theories come to be about the world. To borrow terminology from Lehmkuhl (2020), this model underpins a careful, as opposed to a literal, interpretation of a physical theory. I demonstrate the power of this approach by discussing, as a case study, the interpretation of singularities in classical and quantum gravity.

AGPhil 3.3 Mon 16:15 PTB SR AvHB

On why the prediction of infinite curvature does - while that of geodesic incompleteness does not - indicate breakdown of General Relativity. — •Kiril Maltsev — HITS / University of Heidelberg, Schloss-Wolfsbrunnenweg 35, 69118 Heidelberg

We review three definitions (missing point(s) unsteadiness, infinite quadratic curvature invariant, and geodesic incompleteness) of what a gravitational singularity is, and argue that prediction of a gravitational singularity is problematic for General Relativity (GR), indicating breakdown of the theory, only insofar as it concerns the infinite curvature (IC) singularity characterization. In contrast, the geodesic incompleteness (GI) characterization is GR's innovating hallmark, which is not meaningfully available in Newtonian gravity formulations (locally infinite density field, and locally infinite gravitational force) of what a gravitational singularity is. GI is compatible with but does not require divergence in any curvature quantities. Prediction of IC formation contradicts principles of Quantum Theory and Special Relativity, while that of GI does not. It is the continuous, non-quantized, nature of Lorentzian geometry, which admits indefinite continuation of gravitational contraction. Curvature singularities are admitted to form in GR not only from collapse of mass-energy but even in a vacuum spacetime, for example from collision of gravitational waves, under certain conditions. Therefore, in order to prevent IC formation, instead of imposing a curvature bound as consequence of a limiting mass-energy density, a curvature bound should be imposed by first-principle assumption that the Planck scale is ultimate.