AGPhil 4: Foundations of Classical Gravity

Time: Wednesday 9:30–12:00 Location: A 060

Invited Talk AGPhil 4.1 Wed 9:30 A 060

Einstein Equations and Hilbert Action: David Hilbert's Contributions to General Relativity — •Tilman Sauer — Universität Bern

I will discuss how Hilbert arrived at General Relativity in late 1915 and give a characterization of his perspective on the natural sciences in general and on the foundations of space and time in particular.

AGPhil 4.2 Wed 10:15 A 060

Einstein's Physical Strategy, Energy Conservation, Symmetries and Stability — •J. Brian Pitts — University of Cambridge

Work by Renn, Janssen et al. shows that Einstein found his field equations partly by a physical strategy including the Newtonian limit, the electromagnetic analogy, and energy conservation. What energy-momentum complex(es) did he use and why? Given that Lagrange and Jacobi linked symmetries and conservation, did Einstein tie conservation to symmetries, and if so, to which? How did the work relate to emerging knowledge (1911-14) of the canonical energy-momentum tensor and its translation-induced conservation in Herglotz, Mie and Born? After initially using energy-momentum tensors hand-crafted from the gravitational field equations, Einstein used an identity from his assumed linear coordinate covariance x^m'= A^m_n x^n to relate it to the canonical tensor. Whereas Mie and Born were concerned about the canonical tensor's asymmetry, Einstein did not need to worry because his Entwurf Lagrangian is modelled not so much on Maxwell's theory (which avoids negative-energies) as on a scalar theory (the Newtonian limit) with symmetric canonical tensor. The Entwurf theory has 3 negative-energy field degrees of freedom. Thus it fails a 1920s-30s priori particle physics test with roots in Lagrange's stability theorem—c.f. Einstein's 1915 Entwurf critique for not admitting rotating coordinates and not getting Mercury's perihelion right.

This work is partly collaborative with Alex Blum.

15 min. break

AGPhil 4.3 Wed 11:00 A 060

Prediction in General Relativity — •Casey McCoy — University of California San Diego, La Jolla, USA

Various prominent physicists and philosophers have claimed that prediction is essentially impossible in the general theory of relativity, the case being particularly strong, it is maintained, when one fully considers the epistemic predicament of the observer. I argue that the conditions on prediction advocated by these authors rest on philosophically misguided and unphysical intuitions, and should therefore be rejected as inadequately explicating the concept of prediction in general relativity. Along the way I clarify the epistemic situation of observers and discuss the significance of these arguments for cosmology.

AGPhil 4.4 Wed 11:30 A 060

Against Comparativism about Mass in Newtonian gravity — •Niels Carl Maria Martens — Philosophy Department, University of Oxford

The property of having mass is a determinable with two types of determinates: we think of an object with mass as having a determinate intrinsic property, but we also think it stands in determinate mass relationships with other massive objects. Absolutism about mass is the metaphysical position that the intrinsic properties are fundamental; the mass relationships are then grounded in those intrinsic masses. Comparativism is the position that the mass relationships are fundamental; they are all there is to the property of having mass (Dasgupta, 2013). I will defend the original Newtonian (that is absolutist) interpretation of Newtonian Gravity against recent attempts to reformulate Newtonian Gravity in comparativist terms.