AGPhil 2: History and Philosophy of Gravity

Time: Monday 16:15–18:00   Location: AGPhil-H14

Invited Talk   AGPhil 2.1   Mon 16:15   AGPhil-H14
To G or not to G: J. H. Poynting and the gravitational constant in the 19th century — •Isobel Falconer — University of St Andrews, UK

The increasing precision of gravitational measurement is sometimes given as a reason for the acceptance of the gravitational constant, G, in the late 19th century. However, as late as the 1890s, John Henry Poynting, the doyen of British workers on gravitation, persistently refused to cast measurement of the gravitational constant as his experimental aim; he preferred to present it as measurement of the mean density of the Earth. Despite his detailed analysis, in his Adams Prize Essay of 1894, of the improvements in experimental method that were enabling ever more precise measurement, he similarly interpreted all previous measurements as of the mean density of the earth. His reservations about G alert us to the mathematical, physical and metaphysical interpretative work involved in the shift that had occurred during the previous 100 years, from expressing the laws of physics as ratio equations to expressing them as functional relationships between algebraic symbols that denoted the numerical values of physical quantities.

This talk will encompass gravitational work in Britain, France, and Germany, in exploring the introduction of G into physics and some of the questions raised by Poynting's reservations about G as a useful physical construct.

AGPhil 2.2   Mon 17:00   AGPhil-H14
The Renaissance of General Relativity in the 1960s — •Dennis Lehmkuhl — Lichtenberg Group for History and Philosophy of Physics, Institute of Philosophy, University of Bonn

This talk will focus on the development of new mathematical methods during the 1960s that allowed for new ways of understanding the solution space of the Einstein equations, and subsequently for new avenues to work on cosmology. The focus will be on the classification schemes for vacuum solutions developed by Petrov, Penrose, and Pirani, as well as the global methods developed during the work on the singularity theorems by Penrose and Hawking. Building on this, the talk will outline how both the singularity theorems themselves and the new methods developed in proving them have influenced subsequent work on cosmology.

AGPhil 2.3   Mon 17:30   AGPhil-H14
Holistic Eliminative Reasoning for Astronomy and Astrophysics — •Shannon Sylvie Abelson — Indiana University Bloomington, IN, United States

I argue that a promising epistemology for astronomy and astrophysics (A&A) involves a certain kind of eliminative reasoning. Unlike the traditional conceptions of such reasoning that propose to eliminate rival theories or models based upon quality of evidence, I build upon work by Paul Horwich (1982), Patrick Forber (2011), and Elisabeth Lloyd (2013; 2015) to argue that it is particular model assumptions (variables, parameters, etc.) that are weighed and eliminated. Rather than a veridical comparison between theory predictions and individual observational results, holistic eliminative reasoning has a web-like structure. Elimination is the end result of a multi-step reasoning program that holistically evaluates the introduction of a proposed assumption into the state space of previously accepted evidence. In particular and where possible, model assumptions should cohere with our well-confirmed pictures of dynamical processes and the mechanisms that underlie them. Holistic elimination then becomes a project of capturing dynamical accuracy. These ideas have been explored in the context of biology and genetics (see Lloyd, Lewontin, and Feldman (2008), Forber (2011) and Ratti (2015)), but have not been extended to A&A. I outline how this epistemic framework can be applied to competing dynamical pictures of the mechanisms and conditions underlying the evolutionary histories of black holes, including gas accretion, intermediate mass black hole mergers, and direct-collapse black hole models.